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a
third
dimension
a
good
dimension.

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About This Issue . . .

To provide you with a sample of our monthly publication, *PC Novice* has designed this special issue to help maximize your computer's performance. *PC Novice* includes a variety of tutorials, reviews, and general interest articles that are sure to answer all of your computer questions. If you are interested in subscribing to *PC Novice*, please call us at (800) 424-7900.

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Mac vs. PC

Which Computer "Make" Is For You?

Unfortunately, buying a computer is not as simple as waltzing into your local computer electronics store and picking out the best-looking system. Before you buy, you need to make some decisions about what type of system best fits your needs. The first and foremost of those decisions is what "make" of computer you need—an Apple Macintosh or an IBM-compatible.

It all started back in the late 1970s, when computer components came in pieces and parts (assembly required). Two computer enthusiasts, Steve Jobs and Steve Wozniak, formed a company called Apple Computer and put together a computer that didn't come as a kit. You could take it out of the box, plug it in, and use it without knowing how to wire in a keyboard or install memory. The systems were the first of their kind, packaged and priced so they would be more attractive to a consumer market rather than the corporate market. The Apple II was such a hit that the company's first-year sales were \$2.7 million.

It didn't take long for other companies to notice Apple's success and to create their own versions of the desktop computer. International Business Machines (IBM) introduced its version, the IBM PC (personal computer), in 1981. But IBM did not create its PC to work with the Apple computers. Instead, the IBM computers were made with a different architecture and different foundation software.

At that point, the industry went through a major shift. Most companies realized they couldn't compete with IBM's already established worldwide market. They guessed that IBM's technology would become the standard and began designing their own compatible computers that would operate the same software as the IBM PCs.

But Apple didn't give up. In 1984, the company introduced the Macintosh, one of the first real consumer-friendly computers. These systems had a graphical interface instead of the complicated commands and codes necessary to operate IBM and compatible computers. Apple decided to go it on its own; it had already established itself in the personal computer market.



And so the personal computer market is still divided. On one side is Apple, with its user-friendly computers, and on the other is the IBM and compatible computers, with the lion's share of the market. How do you decide? That's the big question that we hope to help you answer. Here we'll compare the two and explain your options.

■ Brain Power

One of the major differences between the two computer "makes" is the type of microprocessor they use. The **microprocessor**, or **central processing unit**, is a microchip that handles all the main processing functions of the computer, making it a lot like the computer's "brain."

IBM and compatible computers (generally referred to as PCs) use microprocessors manufactured by Intel, and increasingly AMD and Cyrix. These chips have names like the 386 and the 486, although today's most popular, the 586, is called the Pentium. All Apple Macintosh computers used microprocessors made by Motorola. You could find Macintosh computers powered by chips like the 68030 or the 68040.

Nowadays, however, Apple is shifting its desktop systems away from the Motorola chip to another microprocessor called the PowerPC. Almost two years ago, Motorola, IBM, and Apple introduced this small, high-performance chip. (These chips are referred to as the 601, 603, or 604.)

What difference does the microprocessor make to the buyer? It's hard to really measure the microprocessors currently available. They are comparable in power and speed.

There is one feature of the PowerPC that makes it special. Because Apple and IBM were involved with its development, this chip is capable of running DOS/Windows on PCs, as well as System 7 on Macintosh computers. (DOS and System 7 are the operating systems for the two computer makes.) That means if you purchase a PowerMac computer from Apple and it's a DOS-compatible computer, it can run both Macintosh and Windows applications at the same time. Is that enough to sway your opinion one way or the other? We'll discuss it in more depth later.

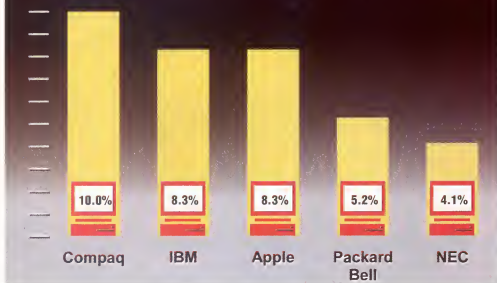
■ "Ease Of Use"

A big catch phrase in the computer market is a product's "ease of use," how hard it is going to be to learn and how long it is going to take. It's no big secret that Apple's System 7 operating system has the clear lead in this case.

Richard Zwetckhenbaum, research director at the market research firm International Data Corp., says the Macintosh platform always has had better ease of use and is easier to adapt to than Windows and DOS.

The Macintosh interface is all menus, icons, and windows. Documents are represented by icons that look like pieces of paper. Directories look like folders so you can store similar things

Top Five Computer Vendors Worldwide in 1994



*Courtesy of Dataquest

together. There's a little trash can that plumps out when you have deleted a file. And it doesn't totally delete until you "empty the trash." There's no need for a special file managing application. To perform tasks like moving or deleting a file, you drag and drop it to a new location. You even can see file statistics (like the date it was made and its size) in a window. There's a built-in tutorial and one mouse button to make everything simple.

In terms of navigating the environment, moving data, and moving between applications, Macintosh wins hands down.

The Macintosh also wins when it comes to system setup. Because Apple is the only manufacturer of systems and hardware extras, there's not a real problem with compatibility. Want to add a CD-ROM drive to your system? Plug it in, the system automatically recognizes the drive, and it's ready to go. Want to add more random-access memory (RAM)? Just plug the memory chips inside, and you've got more horse power.

Try that on a PC and see what happens. Because there are many companies making drives, modems, memory add-ons, and so on, not everything works together quite so easily. You first have to make changes in your computer's startup files so it can locate the new components and communicate with them.

Apple's lead has diminished over time, Zwetckhenbaum says, because the Macintosh interface has not advanced to the degree that

the Windows interface has advanced. Windows is very similar to the Macintosh interface. It has the same sorts of menus, icons, and windows. It has a built-in tutorial and some drag-and-drop options. But the Windows interface isn't as clean and simple as the Macintosh, mostly because you have many more options and built-in features. It has more extras, like a built-in calculator, card file, and calendar. In essence, it can't look as simple because there's a lot more to it. It also depends on DOS as its foundation software. This is somewhat limiting, because when you name files, you are limited to an eight-character name, with a three-character extension.

A lot of IBM-compatible vendors are making the Windows environment even easier to learn, says Richard Corpuz, industry analyst in personal computing at Dataquest. Take, for instance, Packard Bell, IBM, and Compaq to name a few. They are creating custom shells that run on top of Windows. When you start your new Packard Bell computer, for example, the Navigator 2.0 lets you choose to work in a more familiar, three-dimensional environment, such as an office study or kid's room. Besides giving the computer a homey environment, the Navigator also lets users watch tutorials and provides easier access to software programs and organizing and managing files.

Or consider how Microsoft Corp. is making the environment easier for the novice. The company recently introduced an even homier

program that runs on top of Windows, called *Microsoft Bob*. Instead of operating from a group of windows, you work in a virtual room, such as an attic, study, sunroom, or garage. Then a "guide," maybe an on-screen dog, cat, dinosaur, or bird, helps you navigate and accomplish your tasks.

And who can forget the much-anticipated Windows 95? When this operating system comes out in August, it will run faster applications than Windows 3.1 could. It will combine file managing functions in the main screen, just like the Macintosh interface, and will have icons that look like what they represent: documents, spreadsheets, and folders. There's a recycle bin that operates like the Mac trash can and an AutoPlay feature that lets you automatically play CD-ROMs without having to install files and directories on the hard drive (just like the Macintosh). In addition, there are new options only in Windows

95, like a Quick View feature that lets you peek at a document without having to fully open it, or a Taskbar that lets you click a button to instantly bring up a program that is running or minimized.

PCs also are making strides towards "Plug-and-Play" peripherals. When Windows 95 comes out, you will be able to plug a printer, modem, or hard drive into a PC and be able to work with them automatically. The software will do all the configuring. All you need is a computer that is Plug-and-Play-ready, and your peripherals must also be set up for the Plug-and-Play standard.

■ Virtues In The Architecture

If you talk to friends, relatives, or co-workers before you make a computer purchase, they will probably tell you that Macintosh computers are built more for design, graphics, and desktop publishing, the kind of work done at newspapers or graphic design companies. They also may tell you that PCs are better suited for more advanced mathematical applications, such as spreadsheets and databases.

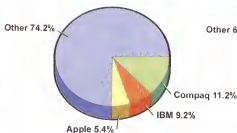
But is it the truth? Not really.

The idea that the architecture of a Macintosh or a PC would make one better at a task than another is more of a perception than a fact of life, says Michael Reiter, spokesperson for IBM.

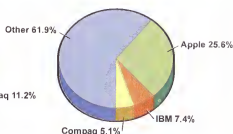
"I think that there are strong marketplace perceptions that people have and that they

Top Computer Vendors By Category

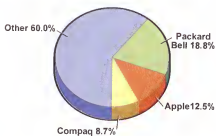
Business



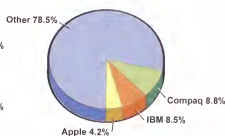
Education



Home



Government



* courtesy of Dataquest

IBM-compatible computers lead the market according to the number of computers shipped during 1994 in the business, home, and government markets. Apple, however, still reigns supreme in education.

attach to particular brands," Reiter says. "This brand is a good bargain, this brand has the best service, and that brand is easier to use. Those are perceptions as much as anything you could actually measure."

Bruce Gee, Apple product manager of entry-level Macintosh systems, agrees.

"If you look back historically, the Mac started as a graphical user environment," he says. "I think this perception of why Macs are good at graphics and PCs are good at numbers is that the Macintosh has a graphical user interface, and it's a natural environment for desktop publishing, design, and artwork."

The PC, on the other hand, is perceived as being good with numbers because it started with DOS' character-based environment. Databases and spreadsheets are more character-based environments.

Based on these perceptions, the graphics and design worlds have seemed to take more to Macintosh computers, while PCs are more accepted by businesses.

You still can do design or graphics on a PC, just as you can do calculations on the

Macintosh. Whether you get better science and math capabilities or better graphics on one system versus the other actually has more to do with the power of the microprocessor, the memory, and other hardware extras.

■ On The Shelf

Peruse the hardware section of any computer section and what do you see? More than likely, there'll be rows and rows of IBM and compatible computers and only a few Macintosh computers.

So goes the personal computer market. According to International Data Corp.'s research, the number of PCs in the 1994 market dwarfs the number of Macintosh computers. The number of brand-name computers shipping in the United States in 1994 was 18.2 million. Of those 18.2 million, 88.1% were Intel-based, one of the most popular PC microprocessor makers.

And that's only the number of computers shipped last year. When you consider the total number of installed computers in the U.S. during 1994, PCs still dominate. Of a total 75.9 million computers in the U.S., about 82% were

Intel-based. Only 8.6 million, or about 11%, were based on the Motorola 680x0 microprocessor, which Apple primarily used in its desktop computers.

The same goes for software. According to the Software Publishers Association (a trade association of the software industry), 65% of the software sold in the United States and Canada in 1994 were Windows applications, with sales totaling about \$4.78 billion. Macintosh applications equaled about 17%, with sales of about \$1.25 billion.

It all adds up to the fact that there are more PCs available and more software programs available and sold to run on them.

The reason, Zwetckhenbaum says, is that there's a larger market for software developers to market their software to, creating an economic incentive for them to create products for Windows. In fact, he says, that's probably the primary advantage to the Windows environment.

Back when Apple decided to go up against the IBM platform, the company did not release the specifics or license other companies to create Macintosh-compatible computers, Corpuz says. While the company may rate in the top 10 of most computer markets (see chart on this page), it's surrounded by PC manufacturers.

Recently, Apple licensed a handful of companies, such as Radius Inc. and Power Computing, so they could use the Macintosh hardware and operating system and create Macintosh-compatible computers. While Radius seems to be creating computers for a high-end graphics/desktop-publishing market, Corpuz says Power Computing is gearing up for the consumer and small business market with systems that have lots of bundled software and very competitive prices.

Although it's too early in the game to see what will happen, Corpuz says this should help to spread the acceptance of the Macintosh computer and increase sales. And that should, in turn, create a larger installed base, persuading more software developers to create applications for the Mac in the future.

■ What It's Going To Cost

With all the competition in the PC market, price wars are bound to arise and drive costs down. On top of that, every IBM-compatible company doesn't have to put a great deal of profits back into research and development because they aren't the only manufacturers out

Head To Head

PowerMac	PowerMac DOS-compatible	IBM Or Compatible Computer
<p>Advantage: Easy-to-use interface; best for multimedia because it doesn't require CD-ROM programs to install themselves and has built-in sound; most popular interface in schools; high usage in desktop publishing and graphics design industry.</p> <p>Disadvantage: Higher priced; only a handful of vendors manufacture the computers; not as many software products available to choose from; fewer units found in corporate businesses.</p> <p>Ideal user: Home user with children who will use the computer; graphics design and desktop publishing businesses.</p>	<p>Advantage: Same as PowerMac; can run both Macintosh and PC software titles.</p> <p>Disadvantage: Even higher-priced systems and upgrade packages.</p> <p>Ideal user: A family willing to pay a premium so parents can bring work home and run applications in the Windows environment while the kids can use the Macintosh side; a small business person who wants the simplicity of the Macintosh but yet needs to operate one or two business programs not available on the Macintosh platform; an office that has both computer "makes" and wants them to work together.</p>	<p>Advantage: More competitively priced systems; larger number of software titles available; substantial usage in the corporate and business market.</p> <p>Disadvantage: Setup and installation of peripherals and CD-ROM programs still not as easy as Plug and Play.</p> <p>Ideal user: Home user wanting access to a large number of software titles for entertainment, education, and finances; business user who wants to be compatible with others in the office or industry.</p>

there, unlike Apple. So when you compare prices, you will find that IBM-compatible machines are a little less expensive.

When we went comparison shopping, we started with the Macintosh Performa 6115CD, which has a PowerPC processor operating at 60 megahertz (MHz), eight megabytes (MB) of RAM, a 350MB hard drive, a fax/modem, a double-speed CD-ROM drive, speakers, monitor, and lots of bundled software for about \$2,400. A comparable Packard Bell Pentium computer running at 60MHz with a 420MB hard drive, 8MB RAM, monitor, software, and all the multimedia components, cost about \$1,700.

Power Computing offers some attractive Mac-compatible systems priced about 10% to 15% less than a comparable Apple computer. They include quality software but are being sold directly from Power Computing instead of through a computer store. For example, a Power 80 system running at 80MHz, with 8MB RAM, a 340MB hard drive, and bundled software will cost about \$2,000. When you figure a couple hundred dollars more for a quality monitor, that's not bad.

The Power Computing systems are a little more powerful than you might find at your average computer store. While you may pay less than you would with an Apple computer, keep in mind you are taking a small risk investing in a system by a company that hasn't been around long enough to prove itself in this market.

■ Mac, DOS, Or Both?

When you add it up, the Apple Macintosh is a friendly, easy-to-use computer that's great for

kids or adults wanting to use a lot of multimedia or use the PC for school. It's a little more expensive, but you're paying for the simplicity.

On the other hand, there are many PCs in the market driving down the prices, and there's a lot of software available. The operating system is becoming easier to use and may even become as simple as the Mac with the release of Windows 95. In addition, people who take work home or work from home more than likely will work on a PC since Apple has yet to really crack the corporate market.

Then again, the PowerMac DOS-compatible computer, which can be purchased as a system or as an upgrade board for PowerMacs, can operate Macintosh and DOS/Windows programs at the same time and even can switch between the two.

Although the PowerMac DOS-compatible sounds like it's the computer to end all others, you pay a heavy price for it. The expansion board and software to upgrade an ordinary PowerMac runs about \$700, while the already-equipped PowerMac 6100 DOS-compatible operating at 66MHz costs about \$2,760.

The PowerMac will run your Windows software at the speed of a 486DX2 at 66MHz, which is a far cry from a faster, 90MHz Pentium costing a little more than \$2,000. So it's not likely you will be buying a PowerMac if you primarily want to run DOS/Windows or Windows 95.

So who would use a PowerMac DOS-compatible?

"The type of buyer that would buy a PowerMac with DOS compatibility is one that is

committed to the Macintosh platform but has a certain degree of requirement to be in the Windows environment," Zwetckhenbaum says.

■ Consider This

So what should you choose? First, you have to consider what you are going to use this computer for.

"I think one of the biggest mistakes people make is that they come at this from the back end, which is to say they have in mind a particular name of a particular chip speed when they shop," Reiter says.

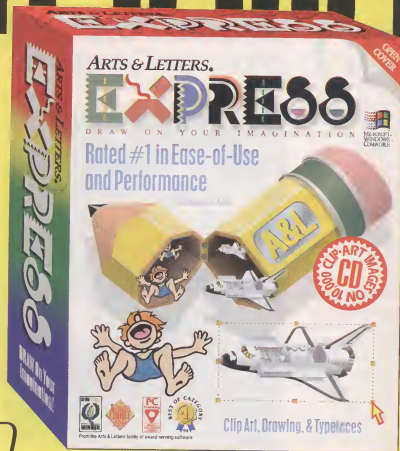
The way to approach it, he says, is to figure out who is going to use the computer and what they want to do. Then head to the software store and see what programs are available that fit those needs. Are they IBM and compatible programs, and are they also available for the Macintosh?

Remember that you will probably be using a computer at work and will want to take work home or share files with your computer at work, Reiter says. Your kids will most likely use a computer at school and will be familiar with that interface and may possibly want a home version of the software they use at school. You also may want to exchange information or diskettes with family members or friends.

Take heart. There's no right or wrong answer, Reiter says.

"It's what you want to use the computer for. If somebody says, 'Oh, you made a mistake,' it's not a mistake if it meets your needs." ●

IT'S SO EASY!

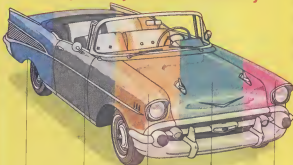


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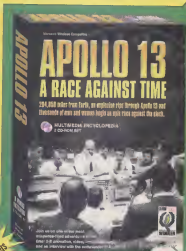


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Windows 95 vs. Windows 3.1

Microsoft Operating Systems Compared

If you listen to the hype, you'd think Microsoft Windows 95 was going to revolutionize desktop computing, making it as easy as child's play, as efficient as a one-man band, and as reliable as the rising sun.

Win95 promises many benefits for users. Much, though not all, of the underlying programming code is 32-bit, compared to the less robust 16-bit code in Windows 3.1. Win95 also allows pre-emptive, or "true," multitasking versus Windows 3.1's cooperative multitasking. This pre-emptive multitasking should make using multiple programs more reliable.

We looked at the final beta version of Win95—the last test version before it was scheduled to ship. This version, by definition, is very close to the shipping version in terms of features and appearance. But, remember that some of the functionality may change by the time the finished product rolls out.

Win95 clearly has significant advantages over Windows 3.1. The question for most computer users won't be whether to upgrade, but when to upgrade.

■ Microsoft Windows 95

In preparation for shipping the final version, Microsoft undertook a huge beta testing program, sending out test copies of Win95 to hundreds of thousands of people. The final beta was sent to nearly a half-million beta testers.

As a result of the extensive beta testing, Microsoft caught and fixed innumerable bugs, added functionality, and improved speed.

Interface. In Win95, Microsoft replaced Program Manager with the simpler and easier Start menu, and File Manager with the more versatile Explorer.

The Start menu is similar to features found in such third-party Windows shell programs as *Dashboard*, *Norton Desktop for Windows*, and *PC Tools for Windows*. To use it, click in the lower-left area of your screen, hold down the mouse button, and select the program you want to run.

Explorer also borrows from third-party utilities in other ways, letting you place icons on the desktop and create folders within folders to make launching programs and managing your hard drive more convenient.

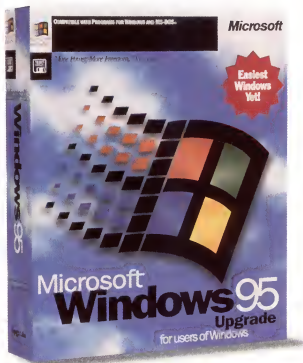
Win95 includes other usability features. Click your right mouse button on a file, program, or drive, and you're shown a menu of options, such as open, copy, or change settings. Right-click on a file, choose Quick View, and you can view the contents of the file without first loading the program that created it.

Win95's interface has its limitations, however. Explorer is still not up to par with third-party desktops used with Windows 3.1 such as Norton Desktop for Windows or PC Tools.

With Norton Desktop, for example, you can quickly go to a subdirectory or a file in a subdirectory by typing its name. After typing the first letter, Norton Desktop takes you to the first entry that begins with that letter. Type the second letter, and it takes you to the first entry that begins with the two letters you typed. The same holds true if you type the third letter, and so on.

With Win95's Explorer, you can type the first letter and go to the first folder (subdirectory) or file that begins with this letter. But if you type the second letter, it takes you to an entry that begins with this letter, rather than using the first and second letter together. This makes navigating your hard drive considerably less convenient.

Win95 is missing other amenities that power users have long enjoyed. To copy a floppy diskette, for instance, you have to open an MS-DOS window and type DOS'



DISKCOPY command. There's no way to do this within Explorer.

Functionality. Win95 allows long filenames. If you're using 32-bit Win95 programs, you'll can create filenames of up to 256 characters. With Windows 3.1, as with DOS, you're limited to 8.3—eight characters plus a three-character extension—which can be confusing.

Win95 provides a Recycle Bin. Have you ever mistakenly deleted a file? MS-DOS and third-party utilities come with undelete programs that usually let you recover from your mistakes. Win95's built-in Recycle Bin, however, is more convenient and nearly foolproof.

When you delete a file or folder, it automatically goes to the Recycle Bin. To reclaim it, double-click the Recycle Bin icon, select the file, and choose Restore from the File menu. Files that go into the Recycle Bin consume space on your hard drive, so Win95 lets you limit how large the Recycle Bin can grow.

To delete files from your hard disk permanently, double-click the Recycle Bin icon and choose Empty Recycle Bin from the File menu. You can change the default settings of the Recycle Bin so it doesn't store deleted files. Or you can select the file and press SHIFT-DELETE.

Win95 has fewer system resource limitations. With Windows 3.1, you can receive an "Out of Memory" error message even when you know you have plenty of RAM to spare. The problem isn't insufficient RAM, but the limited memory that Windows uses for system resources—for tracking windows, dialog boxes, icons, buttons, and so on.

Each program you run uses system resources and, in many cases, programs don't free up the resources they use once you exit them. The result: If you run too many programs or open too many windows simultaneously, no matter how much RAM you have, Windows may crash.

Win95 eliminates much of these system resource limitations. You'll be able to run far more programs and open far more documents without crashing.

Win95 makes it easier to install new hardware by incorporating the Plug-and-Play standard, designed to let you install devices such as printers, fax/modems, and scanners without fiddling with IRQs, DMA channels, I/O ports, memory address ranges, and DIP switches. Macintosh users have long enjoyed this tight integration of hardware and software and, with Win95, PC users will be able to enjoy it as well.

To take full advantage of plug and play, however, your computer needs a BIOS (Basic Input/Output System) and peripherals that support it. Win95 does provide some support for legacy hardware—older peripherals not fully compliant with the Plug-and-Play standard—although you'll have to configure them manually. Fortunately, Win95 includes an Add New Hardware wizard, or help routine, that suggests how to configure new expansion cards so they don't conflict with those already installed.

As long as you're using Win32 programs, Win95 provides more efficient and stable multitasking. Because Win95 employs preemptive rather than cooperative multitasking, you'll can use other programs while doing a long *Excel* recalculation in the background, for instance. On the other hand, with Windows 3.1 you have to wait until

Excel finishes before using another program. What's more, Win32 programs run in their own memory space rather than sharing space. If one Win32 program crashes, it will be less likely to take down other Win32 programs with it.

Win95 provides a one-stop communications tool called Microsoft Exchange. This is an inbox that handles faxes, E-mail, and online services. It promises to interface seamlessly with Internet mail, CompuServe mail, *Microsoft Mail*, and The Microsoft Network. Most people now use different programs for these functions, which can be cumbersome.

Win95 has built-in networking. You can share files, printers, and fax/modems with other computer users, by using the included peer-to-peer networking features. If you're part of a Novell NetWare network, you can connect to it using Win95's NetWare client software.

If you have a dial-up PPP (Point-to-Point protocol) connection, Win95 makes it easier to connect to the Internet. It includes TCP/IP (Transmission Control Protocol/Internet Protocol) stack and socket services, which control how data is transferred between computers on the Internet and allow Windows applications to send and receive data.

Speed. With its 32-bit code, Win95 has the potential to be considerably faster than Windows 3.1. But, at least with the final beta, most operations are slower on a 33MHz 486 PC with 8MB of RAM.

An important point to remember, however, is that beta versions of programs, including this one, have bug-checking code that often slows things down. An accurate performance evaluation will have to wait until the final version of Win95 is released.

To run Win95 acceptably fast, adequate memory is even more important than a spiffy new CPU. Microsoft says Win95 will run with 4MB of RAM, but a more realistic minimum is 8MB. If you plan to run multiple applications at the same time, consider upgrading to 16MB of RAM.

Microsoft also says that when the final version ships, it will be faster than Windows 3.1, and those with newer and faster PCs will see the greatest speed improvement.

Microsoft Windows 95
Microsoft Corp.
(800) 426-9400
(206) 882-8080

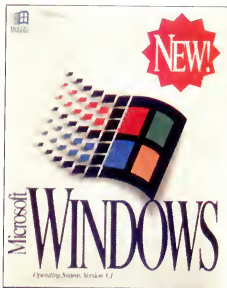
Strengths

- Allows long filenames
- Fewer system resource limitations

Weaknesses

- Interface needs help from third-party utilities
- No internal disk copy function

■ Microsoft Windows 3.1



For millions of users, Windows 3.1 and its application programs have served millions of computer users well, letting them load and run multiple programs simultaneously.

Interface. Though not elegant, Windows 3.1's interface is functional. Program Manager and File Manager are the two key components. Program Manager lets you launch programs with the click of a mouse, and File Manager lets you easily copy, move, rename, and delete files and subdirectories, and perform other hard drive maintenance chores.

Unfortunately, Program Manager and File Manager are not well-integrated, which has provided opportunities for third-party replacement utilities such as Norton Desktop for Windows and PC Tools for Windows. With Norton and PC Tools, as with Win95, you can launch programs and manage files right from the same desktop. With Program Manager, you also can't embed folders within folders, as you can with replacement shells and Win 95.

Functionality. Windows 3.1 added significant functionality to its predecessor, version 3.0. An integrated TrueType font manager lets you see on-screen what your fonts will look like when printed out. The drag-and-drop feature lets you drag a data file from File

Manager to an application minimized in Program Manager to load it automatically. Windows 3.1 also introduced object linking and embedding (OLE), for embedding one application within another.

Still, Windows 3.1 is missing important features. You're limited, as with DOS, to eight-plus-three filenames. There's no undelete command—you have to rely on other programs for this.

Windows 3.1 also has not included file viewers for viewing the contents of files without having to load the programs that created them. Win95 has file viewers for all the popular applications. To search a number of documents for a word or a string of words, you have to rely on other programs with Windows 3.1. Win 95 comes with this feature.

Speed. Windows 3.1 is faster than Windows 3.0. But Windows 3.1 programs, with their graphical user interfaces, are slower than DOS programs with their character user interfaces (CUIs). With fast hardware, however, these speed differences are minimized.

Microsoft Windows 3.1
Microsoft Corp.
(800) 426-9400
(206) 882-8080

Strengths

- Functional multitasking
- Integrated font management
- Weaknesses

- Short filenames
- No undelete or file viewing functions

■ Upgrade Decisions

It's clear that Win95 is a superior interface to Windows 3.1. But should you buy Win95 just after it's been released, or wait? Much depends on your individual situation. You should upgrade now if you need to stay on top of computer developments for clients or co-workers. You also should upgrade if you enjoy being on the cutting edge (sometimes called the bleeding edge) of computer technology.

But, if you want to make the most of your computer software expenditures, it probably will pay to wait a bit. The real value of computer technology is not in the operating system, but in the applications that run on it.

The big unanswered questions right now are: Will Win95 programs take advantage of the 32-bit elements available to them? Will

The New Standard Vs. The Old Standby

	Windows 95	Windows 3.1
Interface		
Graphical User Interface	Yes	Yes
Program Launching Menu	Yes	No
Icons On Desktop	Yes	No
Folders Within Folders	Yes	No
Right Mouse Button Functionality	Yes	No
Quick Subdirectory/File	No	No
Disk Copy	No	Yes
Functionality		
Multitasking	Yes	Yes
TrueType Font Management	Yes	Yes
Long Filenames	Yes	No
File Viewers	Yes	No
File Searching	Yes	No
Undelete Feature	Yes	No
Automated Hardware Installation	Yes	No
One-Stop Communications	Yes	No
Built-In Networking	Yes	No
Built-In Internet Connectivity	Yes	No
32-Bit Disk Access	Yes	Yes
32-Bit File Access	Yes	No
32-Bit Disk Cache	Yes	No
32-Bit Disk Compression	Yes	No
32-Bit Communications	Yes	No
System Requirements		
CPU (minimum)	386DX	286
CPU (recommended)	486/33	386/25
RAM (minimum)	4MB	2MB
RAM (recommended)	8MB or 16MB	8MB
Free Hard Disk Space (minimum)	30MB	6.5MB
Free Hard Disk Space (recommended)	90MB	25MB
Street Price (full product)	\$180	\$90
Street Price (upgrade)	\$90	\$50
Overall Evaluation (out of possible 5)		
Ease Of Learning	☆☆☆☆	☆☆☆☆
Ease Of Use	☆☆☆☆	☆☆☆☆
Power/Capability	☆☆☆☆	☆☆☆☆
Value	☆☆☆☆	☆☆☆☆
Final Word		
	Next personal computer operating system standard	The old standby, still useful for millions

they be appreciably faster and more sophisticated than their 16-bit forebears? Will upgrading to them pay off in terms of greater efficiency, ease of use, and stability?

The smart money at this time answers "no" to these questions, at least for now. With the first round of Win95 programs, you shouldn't expect major improvements. But keep a look

out for versions 1.1 and 2.0 of Win95 applications, which should begin appearing next spring. This is where the real improvements should surface. ●

by Reid Goldsborough

486, Pentium, PowerMac...

No matter how fast your PC is, it can't outrun a power problem

(Get Uninterruptible...starting at \$119)

Just don't have the time for power problems on your PC? Don't worry. They'll always make the time for you. It's not if a power problem will occur, but when. Due to household appliances, poor wiring, bad weather or even other office equipment, power problems are as inevitable as death and taxes.

IN THE NEXT THREE MONTHS, MORE THAN 30,000,000 PCs WILL BE HIT BY POWER PROBLEMS...

In fact, you have better odds of winning the lottery than of escaping the sting of power problems on your PC. One study discovered a typical PC is hit over 100 times a month, causing keyboard lockups, hard drive damage, and worse. And since surges and blackouts represent more than 85% of power problems likely to hit your computer, standard surge suppressors are literally power-

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Surge protection backed by up to a \$25,000 insurance policy protects valuable computer hardware from loss

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Raw AC



Safe AC

APC Uninterruptible Power Supplies provide instant battery backup to protect your data from loss and your hard drive from damage. Units are even backed by up to \$25,000 in lifetime surge protection insurance.

lessen protect you. And a study in a recent PC Week showed that the largest single cause of data loss is bad power, accounting for almost as much data loss as all other causes combined.

PROTECT YOURSELF BEFORE YOU KICK YOURSELF...

Get instant backup power from an APC Uninterruptible Power Supply and prevent keyboard lockups, data loss, and hard disk crashes. Surge protection performance is even backed by up to a \$25,000 Lifetime Equipment Protection Guarantee.



Ask for APC at your computer reseller today or call for your FREE handbook. Starting just \$119, an APC UPS is serious protection no serious computer user should be without.



"Don't take chances...get the ultimate protection... from APC." - PC World



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"We reduced our maintenance costs the first year by 50% in repairs of equipment." Valentin Gonzalez, Pfizer

"Our server was running a project when it lost power... messed up all the data files. It took four days to recover. But we don't worry anymore since we got APC." Tony Chen, DeAnza Systems

"We were working on a state bid when the power went off. APC saved the day and year and future... about 800 pages of data saved thanks to APC." Ben Iyer, Software Galleria

"A power surge did significant damage to all of our systems except those protected by APC. The APC units were undamaged." C. Jeffrey, C. Jeffrey Eng.

"APC has virtually eliminated downtime in our corporate network." Kurt Roemer, Seale Corp.

"Power went out while processing payroll. If not for APC we would have had a walkout!" Suzi Higginson, OSI Inc.



How often were Don Teague knows first hand about APC reliability. "It might be he against the law to buy a computer without an APC Back-UPS 250. I recently had a direct lightning bolt right outside the house, my computer never blinked."

"APC lets me sleep better at night. How much would you pay to get back that one day you worked all day to complete for the boss who gets on the plane at 8:00 a.m. You should assume that you'll buy a UPS, not that it's some luxury item." R. Morella

A power surge wiped out the FAT tables on all PCs not protected by APC. Now have APC installed on all. Craig Post, Comm Tech.

"Before I purchased the UPS I had to put in at least two hard drives at \$1000. With APC products is 'no new hard drives in two years!'" S. Foreman, ISP

Solutions



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MICROSOFT
WINDOWS
COMPTIBLE

In Search Of Windows Help

What should you do when Microsoft Windows unexpectedly throws your PC into a dizzying loop of error messages, blank screens, and warning boxes? Contacting Microsoft technical support, selecting a Windows information book at the local bookstore, or calling a computer-literate friend are all options. But what do you do if the chaos strikes at 3 a.m.?

Rather than wake up (and lose) a friend with a predawn call, why not try one of the other help options available for Windows? We'll show the wide array of Windows help options that are available at 3 a.m. or 3 p.m.

■ At Microsoft

The best place to turn for information about Windows is the original source—Microsoft. The creator of Windows has many sources for information and help about the operating environment.

Bulletin Board System (BBS). You won't be able to directly communicate with Microsoft personnel concerning exact problems with Windows through the company BBS, but you can find information and files for improving your work in Windows. With a modem, dial (206) 936-6735 at any time to access the BBS. You can download Windows 3.1 printer drivers, video drivers, audio drivers, troubleshooting tips, and Windows help files. You won't be charged for the service, other than a long-distance phone charge.

FastTips. The Microsoft FastTips are available 24 hours a day, seven days a week by calling (800) 936-4200. You must use a touch-tone

phone to navigate the automated attendant. The service contains answers to common Windows questions as well as a number of technical information files. You can receive the information at no charge via a voice recording or by fax.

Technical Support. Call (206) 637-7098 at any time to contact Microsoft technical support personnel. This service is available to you for 90 days after you make an initial call to support for a particular software product. (Microsoft starts counting as soon as you make your first call about a product, not from when you purchased the product.) Although there is no direct charge for using this type of technical support, you will pay long-distance charges. Always use a phone that lets you be at your computer. You also should know such things as your computer hardware information, exact error message wording, and any troubleshooting techniques you attempted. Be prepared to spend plenty of time on hold.

If you bought a computer with Windows preloaded, you may have to contact the computer's manufacturer for Windows technical support. Microsoft has support agreements with many computer manufacturers, called Original Equipment Manufacturers (OEMs), who preload Microsoft software. To contact an OEM for Windows technical support, call (206) 637-7098 to obtain a telephone number.

Use of Microsoft's other technical support options will cost you usage fees. With Microsoft Support Network's priority support, you can contact a support engineer at any time. You have two billing options—to your phone bill or to your credit card. If you expect a short call, try (900) 555-2000, where you'll pay \$1.95 per minute—up to a maximum of \$25—that will be charged to your phone bill. Your per minute charges don't begin until you've navigated the automated attendant and started talking with a human being. You can call (800) 936-5700 as well, and a \$25 charge—regardless of the length of the call—automatically will be assessed to your credit card.

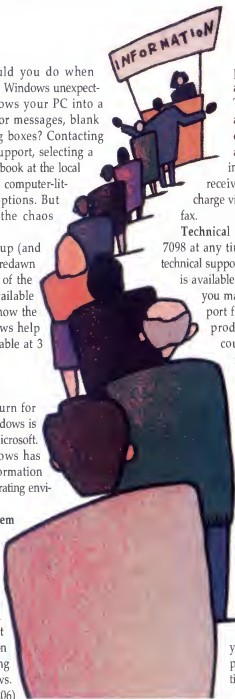
Another option is an annual support plan, giving you unlimited access to Microsoft support personnel for a yearly fee. To obtain information, contact Microsoft Support Network's sales information at (800) 936-3500. At this number, you can gather information on purchasing and upgrading software, obtaining replacement diskettes and manuals, or registering your software.

Training. A number of independent organizations across the United States form the Microsoft Solution Providers. They provide consulting, technical support, and training centers for Microsoft products. Training is available for both the beginning and advanced users for all Microsoft software products, including Windows. For more information, call (800) 426-9400, and Microsoft will refer you to a local organization.

■ Online

The major online services all cater to the Windows user, containing downloadable programs, Windows news, and, once in a while, an online Windows expert. Perhaps the most helpful online feature for Windows users, though, is the chance to speak with other Windows users, either through chat rooms or a bulletin board posting. Chances are, a fellow cyberspace explorer has conquered the Windows problem you're experiencing. All you have to do is ask.

Here is what we found for Windows users on the three major online services. A fourth



online service, the Microsoft Network, eventually should offer extensive Windows help options, but it is still in the early stages of development at the time of this writing.

America Online. AOL offers the Windows Forum, an area containing bulletin boards, Windows files for downloading, and chat sessions. The online service's staff offers answers and advice for general and technical Windows problems through E-mail, bulletin boards, and chat sessions, but users are encouraged to help others by answering questions that fit within their areas of expertise.

To access the Windows Forum, click on the Go To menu at AOL's main screen and select the Keyword command. Type **windows** in the dialog box and hit ENTER. Then click on the Windows Forum button.

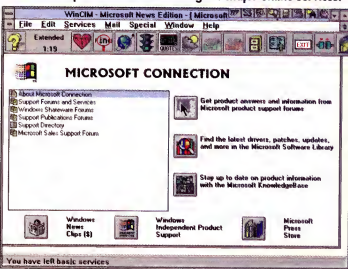
CompuServe. CompuServe has the most comprehensive Windows help areas among the major online services. The Microsoft Connection is the star of Windows' presence on CompuServe, featuring an array of technical information and more than 40,000 technical articles. The Microsoft Connection contains the Microsoft Software Library, where users can download drivers, applications, and Microsoft files, and the Microsoft Knowledge Base, where users can obtain product information.

Users can exchange information and Windows tips in the numerous bulletin boards, or forums, within the Microsoft Connection. Microsoft moderates the eight forums, which include topics such as Microsoft services, Microsoft information, operating systems, Windows, and Windows vendors. Forums are available in several languages as well. To access the Microsoft Connection, click the Go button, type **microsoft**, and hit ENTER. Clicking the Go button and typing **windows** sends you to the Microsoft Connection as well.

Inside the Microsoft Connection is the Microsoft Windows Forum, which contains the largest collection of drivers for Microsoft software and has various bulletin boards and chat rooms. To directly access the Microsoft Windows Forum, click the Go button, type **mswin**, and hit ENTER.

Prodigy. We didn't find much Windows help on Prodigy; only a few downloadable files and a

CompuServe's Microsoft Connection is the most comprehensive Windows help area available among the major online services.



few bulletin boards devoted to computing and Windows topics. To find the bulletin boards, click the Computers button in Prodigy's main screen. Then click the Computer A-Z List button, followed by the Computer Support button. Finally, click the Software BB button to access the bulletin boards.

BBSes. Dozens of private BBSes have areas devoted to Windows information or have subscribers who can provide help.

Books

You'll have no problem finding books dealing with Windows—especially ones full of the same old tips. A few provide some different and useful information, though. Here are some of the best books we found that provide a solid mixture of technical and beginner information in an easy-to-understand format.

"Learning And Running Windows 3.1". Written by Craig Stinson and published by Microsoft Press, it covers a wide range of topics concerning Windows, including beginning and advanced material. Some of the advanced material includes working with DDE (Dynamic Data Exchange) and OLE (Object Linking and Embedding), customizing Windows, using Recorder, printing documents, working with non-Windows applications, customizing the Setup program, and working with conventional, extended, expanded, and virtual memory.

"More Windows 3.1 Secrets". Written by Brian Livingston and published by IDG Books Worldwide (also see "Windows 3.1 Secrets" by Livingston and "Windows 3.1 Configuration Secrets" by Valda Hilley and James M. Blakely),

it discusses customizing Windows, making DOS and Windows work together, and working with Windows icons, Windows fonts, CD-ROMs, printers, COM ports, and .INI files. "Windows 3.1 Secrets," which is the oldest of the three books and contains some out-of-date information, features general tips for using Windows, as well as information for optimizing your hardware to work with Windows and information on Windows shareware programs. "Windows 3.1 Configuration Secrets" contains information on maximizing your RAM for use with Windows and using Windows for Workgroups.

"Microsoft Windows 3.1, Special Edition".

Written by Robert Cowart and published by Sybex Inc., it offers tips for networking in Windows, tips on using DDE and OLE, reviews of Windows add-on programs, and scores of techniques for troubleshooting.

"Microsoft Guide to Optimizing Windows". Written by Dan Gookin and published by Microsoft Press, it provides information on creating the ideal Config.sys and Autoexec.bat files for Windows, developing the perfect Windows hardware setup, optimizing Windows for use with a network, and using multimedia in Windows.

"Ultimate Windows 3.1". Written by Richard Wagner, Jim Boyce, Forrest Houlette, Randall Kennedy, and Kevin Stoltz and published by New Riders Publishing, it gives tips for fine-tuning Windows' performance, using video in Windows, optimizing your computer's RAM for using Windows, working with scanning, OCR (optical character recognition) and graphics in Windows, exchanging data between DOS and Windows applications, and using multimedia.

"Using Windows". Written by Ron Person and others and published by Que Corp., it deals with data sharing in Windows, basic and intermediate operation of Windows, multimedia in Windows (including CD-ROMs and video), networking, troubleshooting, and various Windows applications. It contains information on Windows for Workgroups as well. ●

by Kyle Schurman

Installing Software

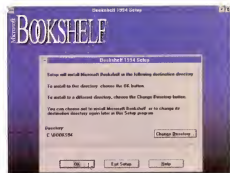
Quick And Painless

file.) The program let us choose whether we wanted a complete or custom installation. We also were given the option of installing printer drivers. We needed to know the type of printer we had in order to install the correct driver. The installation program then took control, prompting us when to install new diskettes and showing us a progress graph. We had a few chances to change the program's setup, but we were able to accept the default settings each time.

■ Windows

Because of its point-and-click graphical interface, the advent of Microsoft Windows forced programmers to make installation programs easier. Most Windows programs handle nearly every aspect of the installation procedure, allowing you to customize the installation when necessary. (Windows is an operating environment designed to run on top of DOS.)

For our example, we'll take you through installation of *Microsoft Word for Windows*. After starting Windows, we selected the Run command from the Program Manager's File menu.



The installation program for the *Microsoft Bookshelf Windows CD-ROM* program is virtually automatic.

Ever notice how when the doctor tells you, "This shot won't hurt a bit," it *always* hurts; then it swells, and you can't lift your arm for a week?

Or how the dentist always waits until he has two fingers, a drill, and a mirror in your mouth before asking if you mind if he fills that additional cavity he just spotted. That's when you wonder why they can't be more truthful with you upfront.

In the early days of personal computing, software companies had their own painful problem they didn't like to discuss—difficult installation procedures. Five years ago, with some programs, you had to identify correctly every basic hardware component in your computer system to get your software to work properly. It was technical torture, similar to pulling teeth with no painkiller . . . and rusty pliers.

Installation programs have become increasingly automated, though. Thick installation manuals have been replaced in many of today's programs by a brief listing of installation instructions on a diskette label.

Today's software can virtually install itself. The majority of programs can identify your system configuration and create a directory in which to install their program files. You'll still find tough-to-install programs lurking on store shelves, but they're few and far between.

Despite the improvements, software installation for the novice still can be a little confusing, especially if you're unfamiliar with the terminology. We'll give you some examples of installation procedures for a typical program written for each of the major PC operating systems. See "Tips For A Smooth Installation" for pre-installation preparations.

■ DOS

While DOS installation programs will cause the most headaches, especially for those new to computing, they've made tremendous ease-of-use improvements. (DOS, or disk operating system, is the operating system software used to run the majority of IBM-compatible computers.) We'll use *WordPerfect for DOS* as our example. We inserted installation diskette 1 in our A: drive, and at the DOS prompt we typed:

```
a:\install
```

and hit ENTER. (Most DOS programs use *Install.exe* as their installation program

We inserted installation diskette 1 in our A: drive, typed:

a:\setup

on the Command Line in the Run dialog box, and clicked the OK button. (Most Windows programs use Setup.exe as their installation program file.) The installation program was fairly automatic. The program gave us the option of performing a Typical Installation or a Minimum Installation, which would require less hard drive space. The program also gave us a choice of installing certain add-ons, such as clip art images. The installation program created a program group and icons for us and prompted us when to install new diskettes.

■ Macintosh

Apple Macintosh programs have always been easy to install because of simple-to-use installation programs that take care of everything. For our example, we'll use *Quicken 5* for Macintosh. (Macintosh computers can't run programs designed for IBM-compatible, and vice versa, without special software.)

We inserted installation diskette 1 in our diskette drive and double-clicked on the diskette's icon. In the diskette's window, we double-clicked on the *Quicken 5* Installer icon. *Quicken's* installation program took care of everything else. All we had to do was choose the folder (same as a directory in IBM PC terminology) where we wanted to store *Quicken* and swap diskettes when prompted. You never will have to identify a hardware component with a Mac program.

■ CD-ROM

While CD-ROM programs used to be difficult to install, they're now as easy as any diskette program, although some CD-ROM software packages aren't clear about whether you should install from DOS or Windows. (CD-ROM, or compact-disc, read-only memory, is a form of data storage that uses laser optics rather than magnetic means.)

The biggest problem you'll have with installing CD-ROM programs is if your computer doesn't have the system configuration needed to run the software. For instance, you might experience problems with a shortage of available RAM for some CD-ROM programs.

Tips For A Smooth Installation

Backup. Always make backup copies of your Autoexec.bat, Config.sys, and .INI files before installing a new program. Some programs automatically will edit those system files without your knowledge. If such editing causes your system to crash, you can at least return to the setup you had before installing the program.

Backup, again. Always make backup copies of program diskettes before you begin installation. (Your software license agreement allows you to make one copy of the program for backup purposes.) Then use the backup copy for installations. You'll have the original diskettes in reserve if your backups become damaged or lost. Creating a backup copy of a CD-ROM isn't feasible for most people, but you should have backups for all other programs. Investing a few dollars in diskettes and having a backup routine will be more than worth the hassle if an installation diskette for a \$495 word processing program disappears. Sorry, but your warranty doesn't cover a diskette you lost or your dog used for a chew toy.

Close programs. Close all other programs before beginning an installation. Some programs cannot install properly with other files open, or they could damage open program files.

Help. Most programs have built-in, online help features. If you're looking for additional advice about installation, reading files with .HLP extensions or with names similar to Readme.doc sometimes provide valuable

information. Such files often contain information that doesn't appear in the user guide. Use DOS' TYPE command or Windows' Notepad to view the files.

Registration. Filling out the card isn't the first thing you want to do when you open the software package. It's important, though, because some companies won't provide technical support until they receive your card. Some companies have limited money-back guarantees or limited time for free technical support, and the clock starts ticking when the clerk hands you a receipt. If you're exceptionally tardy in returning your registration card, you could lose out on these benefits.

System components. You don't need to know all of these as you did in the past, but some programs will ask your brand of sound card or location of a modem. Make certain you have enough hard drive space.

Technical support. You probably won't need it, but it's a good idea to have the phone number handy anyway. You should make certain you have a phone you can use while you're sitting at the computer, too.

User guide. Yes, it's boring reading. But you should at least glance through it before beginning installation, because you can get an idea for any odd program quirks. Reading the sections dealing with installation and troubleshooting probably will be most helpful. ●

We'll use the Windows CD-ROM program *Microsoft Bookshelf* for our installation example. After starting Windows, we clicked on the File menu in Program Manager and then on the Run command. After inserting the *Microsoft Bookshelf* disc in the CD-ROM drive, we typed:

d:\setup

on the Command Line in the Run dialog box and clicked the OK button. Most CD-ROM drives are labeled as the D: drive, although some are called the E: drive. CD-ROM software uses Setup.exe and Install.exe as installation program files.

The installation for *Microsoft Bookshelf* was automatic from there. The installation

program paused several times, letting us make changes to the program's setup, but we didn't need to change the defaults. The installation program listed the components our computer system was missing that would prevent full use of the program's features, such as a sound card.

The actual installation took a few seconds because CD-ROM programs install only the files they need to operate. The majority of files remain on the disc.

A DOS CD-ROM program will use a similar installation pattern to the DOS program described earlier. You're more likely to experience problems with available RAM, though, when installing a DOS CD-ROM program. ●

Choosing A CD-ROM Drive



During the past year and a half, the number of choices among CD-ROM drives has exploded. The shop that carried one or two drives in 1994 may easily carry a dozen or more today, and the differences between them can be dramatic. For CD-ROM novices, these differences can make purchasing a CD-ROM drive a confusing—and intimidating—process.

■ Speed

Speed is measured in several ways. The most important specification in a CD-ROM drive is the **data transfer rate**—how fast the CD-ROM drive can read data from a disc. The faster the transfer rate, the more natural motion will appear. The market standard is becoming 600 kilobytes (KB) per second and is called quad-speed. It is four times faster than the original single-speed (150KB) drives. Other drives include the double-speed drive, which has a data transfer rate of 300KB per second, and the triple-speed drive with a rate of 450KB per second. The double-speed drive was the standard until late 1994. (A kilobyte is the equivalent of 1,024 bytes.)

The **access speed** is the time required for a drive to prepare itself to read data from the disc. This speed is less important than the data transfer rate. It may become a factor, however, when searching a legal database or a national telephone directory where access speed is a key factor in how fast the application runs, according to Plextor, a leading CD-ROM drive manufacturer. It usually is best to choose a fast transfer rate over a fast access speed.

Although many drives boast “multi-spin” or “dual-speed” technology as a “unique”

product feature, all drives have very similar technology. Because data is laid out in circles on the disc, all discs must spin faster when reading data near the center than when reading data near the outside edge. Because they must slow down to 150KB per second to read an audio passage and speed up to 300KB, 450KB, or 600KB per second to read other types of data, they all have some version of dual-speed technology, regardless what competing manufacturers call it.

Another factor affecting speed is the buffer. A **buffer** reads ahead and stores data, allowing it to be accessed very quickly. Although a larger buffer may seem better than a smaller one, its performance depends upon the efficiency of the **firmware** (the instructions permanently embedded on a chip). The only way to evaluate a buffer is to read the product evaluations and tests published in consumer magazines or by reading the specification sheets available from a dealer.

■ Interface

CD-ROM drives have three interface options: IDE, proprietary, and SCSI (pronounced “scuzzy”). Both SCSI and IDE interfaces tend to have faster access times than proprietary boards, according to Tony Rodrigues, audio products manager at Orchid Technologies, a manufacturer of multimedia system audio cards.

The IDE, or **Integrated Device Electronics**, interface standard is used for the latest hard disk controllers, which come with the PC. It is not **backward-compatible**, meaning it is incompatible with older hard disk controllers. With this type of interface, the controller

electronics reside on the drive itself, eliminating the need for a separate adapter card. If you are upgrading and want to add an IDE-based CD-ROM drive, you also must add an IDE interface card. (The current IDE standard is called “Enhanced IDE.”)

Proprietary interface boards offer a good price point and are produced by Sony, Panasonic, and Mitsumi, among others. However, they tie you to one company for support and upgrades. This is particularly disadvantageous because your range of options is severely limited when you are ready to upgrade your components.

The **SCSI**, or **Small Computer System Interface**, controls CD-ROM drives, hard disks, scanners, printers, and other peripherals. Because it has been used for several years, the bugs have been worked out, and SCSI is now considered to be the most reliable type of interface. SCSI cards can handle up to seven peripheral devices and are designed so the devices can communicate directly with each other, without going through the **central processing unit** (the “brains” of your computer), thus saving time and reducing a computing bottleneck on busy systems. SCSI’s added intelligence is rarely used by home and small office computers because those systems typically have only one SCSI device on a port.

The primary advantages of a SCSI-based CD-ROM are that the open slots inside your PC are saved for other uses and that installing upgrades from different manufacturers is a matter of swapping boards. In multitasking environments, and in environments that use both DOS and Macintosh computers, SCSI also is

recommended. All Macintosh PCs come with a SCSI (but not an IDE) port to allow a SCSI-based CD-ROM drive to be added.

SCSI interface boards come in 8- and 16-bit versions. The difference between an 8-bit and a 16-bit board is the difference between a two-lane and a four-lane highway. (A **bit** is the smallest unit of information handled by a computer. A group of eight bits is called a byte.) Twice as much traffic can travel on a four-lane highway. If you buy a single- or double-speed CD-ROM and only plan to connect it and nothing else (not even a hard drive) to the SCSI board, an 8-bit board will suffice. This is because single- and double-speed CD-ROM drives can't pump data fast enough for users to gain anything by going to a 16-bit board. If you choose a triple- or quad-speed drive and are going to plug a hard drive into the SCSI board, use a 16-bit board for satisfactory performance.

■ Adding Sound

Sound isn't necessary for a CD-ROM, but it is nice. The most common stumbling block here is simple cable connections. There are no standards yet for the connections between CD-ROM drives and sound cards, so finding a cable that fits at both ends is tricky. Manufacturers say this is one of the best reasons to have your dealer, who is likely to have the right cables, install the drive and sound card.

For the best sound quality, choose a 16-bit sound card. You can hear the difference; 16-bit sound cards provide a more robust, stereo-like sound, whereas 8-bit sound cards are more like a mono channel sound. Be careful, though. The 16-bit designation refers only to the card's audio channel. For optimum performance, ensure that the card provides 16-bit SCSI.

■ Compatibility

Most CDs can be played in any CD-ROM drive, including the CDs you play on your stereo. The exception is multisession photo CDs, which can be read only by CD-ROM drives. If the drive is capable of reading multisession CDs, ensure that the interface board and software device driver support multisession photo CDs. To view these CDs, you must install special software (such as *Cored Photo CD Lab*, *Kodak Access Plus*, *InCat Magic Lantern*, or *Adobe Photoshop*).

Some drives say they are "XA Ready." XA is an acronym for **eXtended Architecture**, a technology that extends the capability of standard

discs but is not yet used. Even with an XA Ready CD-ROM drive, you would have to add an XA decoder board, which is relatively rare, to play an XA title. If the CD-ROM drive you choose has this capability, you will be ready if the technology catches on. Otherwise, it's not necessary.

■ Physical Features

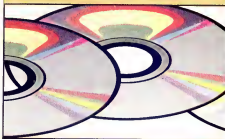
The choice between an internal or external CD-ROM drive is personal. Plextron, Chinon, and other leading manufacturers offer both, with no difference between the specifications of their internal and external models. The real questions are "Do you have the space on your desk?" and "Do you want to carry the drive to multiple computers?" Some PC manufacturers, including Compaq, offer multimedia PCs with everything you need pre-installed. If you are buying a new system, this is worth considering.

Drives come with either a caddy or tray-loading mechanism. This is the most vulnerable part of any CD-ROM drive. The tray mechanism is the easiest to use, operating like the tray on a stereo CD, but is subject to damage when open. The tray has been appearing increasingly on lower-end drives but can offer years of excellent service with normal care.

A caddy operates like a diskette drive. With automatic-loading drives, once a caddy (the disc in a plastic case) is inserted about halfway into the drive, the drive pulls it inside. Then a door on the bottom of the caddy pops open, the disc begins to spin, and a laser underneath the disc reads the information on the disc. The most common problem with a caddy is the jamming of the caddy into the drive, which is caused by users trying to insert the disc all the way inside, like they would a diskette. If you choose an automatic-loading caddy, it should have an emergency eject mechanism so a stuck disc can be retrieved without damaging the drive. Manual drives avoid the problem of jamming because users push the CD-ROM all the way into the drive, like a diskette. Manual drives are considered virtually impossible to break.

Armed with the technical information you've learned here, as well as your answers to the questions in the sidebar "Purchasing Points To Ponder," you'll find that buying a CD-ROM drive isn't as intimidating as you once thought. ●

Purchasing Points To Ponder



- If you're only going to use the CD-ROM drive to listen to audio CDs, you easily can keep your double-speed drive.
- If you're going to be creating or accessing animation or other moving video images, it would be best to use a higher-speed drive. While these tasks can be accomplished with a double-speed CD-ROM drive, higher speeds will make programs run smoother (i.e., no jerky movements).
- If you plan to keep the drive for the life of your system, you may want to invest in a higher-speed drive now. If you're looking for a stopgap and plan to upgrade quickly, consider a lower-speed drive. In the long run, however, a higher-speed drive is probably your best bet.
- If you have children, a majority of your software probably will include games and educational packages with video and animation. In this case, you'd be wise to buy a higher-speed drive.
- When buying a CD-ROM drive, you should be less concerned with brand name than with available technical support. Be sure the shop from which you buy the equipment provides technical service or can recommend a reputable service technician.
- Compare prices and warranties. An exceptionally inexpensive CD-ROM drive might be attractive initially, but if it's not backed by a warranty, you may want to proceed with caution.
- Drives can be bought through mail-order companies. You, or someone else, will need to install the new drive. Another point to consider is that you are on your own when buying from a catalog, and you'll need to know what you want before you order. ●

How To Install A CD-ROM Drive

Internal. External. SCSI. IDE. Double-speed. Triple-speed. These words have no meaning to those who haven't had any contact with CD-ROM (compact disc, read-only memory) drives. But as foreign as these words sound, the lure of games, references, and educational material found only on CD-ROM attracts many computer users. Not to be left out, you've decided to jump on the bandwagon and install your own CD-ROM drive. You've mastered the terminology and can quote in your sleep the advantages and disadvantages of internal and external drives.

Internal CD-ROM drives, which fit into your computer and sit just below the floppy drive, use the computer's power supply instead of requiring their own. They also occupy less desk space and tend to cost less because they are usually IDE-, rather than SCSI-controlled. IDE (Integrated Device Electronics) controller electronics are housed on the drive itself, eliminating the need for a separate adapter card. SCSI (Small Computer System Interface) is more expensive because the price of silicon raises the cost of the computer chips in this interface. Most home PCs have Enhanced IDE controllers and would require SCSI (pronounced "scuzzy") host adapters to run a SCSI drive, further increasing the installation price. (For more information on SCSI vs. IDE, see "Hop On The (SCSI) Bus" in the March 1995 *PC Novice*.)

Even with all the advantages of internal drives, there is one major disadvantage. Internal drives can't be transferred from one machine to another, preventing two computers from sharing one drive. External drives, on the other hand, can be unplugged and moved around without any problems, says Tim Meyerhoff, a Panasonic products specialist for multimedia.

External drives, which sit outside the actual computer, have several other advantages, with the most notable being that they are primarily SCSI. Meyerhoff says external drives rarely

have IDE drives because the data transfer cable connecting the drive to the computer usually doesn't extend more than 18 inches, meaning the CD-ROM drive has to be located fairly close to your computer. SCSI cables, on the other hand, can be up to three meters in length, allowing users to set the drive some distance away from the connected computer. Users do, however, pay a price: external devices demand valuable and already-limited desk space.

For serious CD-ROM users who can afford a more costly setup (SCSI drives cost from \$50 to \$100 more than IDE), Meyerhoff says consumers should invest in a SCSI drive because up to seven peripherals can be connected to one SCSI host adapter while IDE limits users to four. SCSI also has faster data throughput when compared with IDE, but consumers pay for this faster data transfer. Therefore, he says, users "need to weigh cost factors against computing needs" in order to determine which system best suits them.

■ Drive Speeds

Users also must consider drive speed. The speed of the drive determines picture and sound quality and how quickly information is transferred between the disc and the computer. The faster the drive spins, the faster your computer can run programs stored on compact

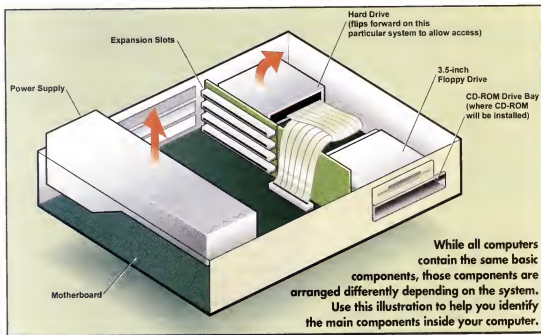
disc. The faster your computer gets the programs, the better the programs will look because the pictures will pop on-screen more quickly and the sound will be less choppy.

A stereo compact disc player spins your audio CDs in single speed. CD-ROM drives don't come in this speed because the discs aren't spun fast enough for the computer to access the information. CD-ROM drives come in double-, triple-, or quad-speed with quad having the fastest spin. Meyerhoff recommends that consumers buy double-speed drives for now because most applications aren't developed specifically for quad speeds.

For best installation results, consumers should buy a multimedia upgrade kit, which comes with a CD-ROM drive, sound card, speakers, and software. Purchasing the kit means you won't have to shop around for each part separately and eliminates the risk of buying incompatible parts.

■ Installation Preparation

Now that you've bought your drive, you're ready to roll... almost. *Before you begin the installation, make sure you read the instruction manual that came with the CD-ROM drive to familiarize yourself with the procedure.* While the manual will tell you exactly what tools you'll need for this procedure, a Phillips screwdriver is a necessity. You'll also

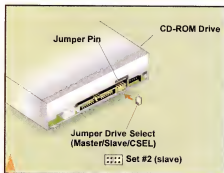


need several kilobytes (KB) of free hard drive space (your manual will tell you how much and any other specific requirements). The Panasonic double-speed, enhanced IDE, internal drive we installed required a minimum of 37KB. We installed this drive on a Hewlett Packard Vectra 4/66; therefore, our illustrations of the computer's insides may look different from your computer, as placement of the basic components change with each type of computer. However, the components illustrated are in all computers; you may just have to look a little harder to locate each part.

(Note: Keep your interface board in its static-resistant packaging until you're ready to use it. Static electricity, along with dirt and oil from your hands, can damage the board.)

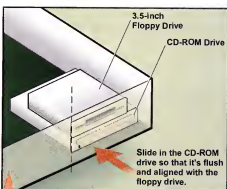
■ Installing The CD-ROM

1. Unplug the monitor and the computer from their power sources, then disconnect the monitor from the computer. Remove the cover from the computer's case, either by taking out the necessary screws along the edge of the case or by unclaspings any hooks and sliding the top off. Before handling the computer parts, ground yourself by touching the metal part of the case in order to prevent electrical damage to the computer's circuits. After grounding yourself, don't move around too much to prevent the buildup of static electricity. To do this, make sure all the parts you'll need for the installation are handy and that you have plenty of room on your desk to complete the procedure.



2. Remove the metal plate covering the drive bay where you want to install the drive and take the drive out of its plastic shipping wrap. You will now need to consult your installation manual to see what setting your drive's jumpers should be on. These jumpers are located on the back of your drive and are used to set the ID. Most jumpers are already

set to the proper ID by the manufacturer when you receive the CD-ROM drive, but you may want to double check these settings to prevent any installation mishaps.



3. You're now ready to slide the new drive into the vacant drive bay, making sure the CD-ROM is even with the floppy drive. If your computer has a floppy drive, you may need to take out the screws holding the drive in place and slide the drive forward a couple of inches (*don't disconnect the drive's cables*) to give yourself more room to work inside the computer. If there are any cables in the bay where you want to install your drive, move them out of the way so the drive can slide in.

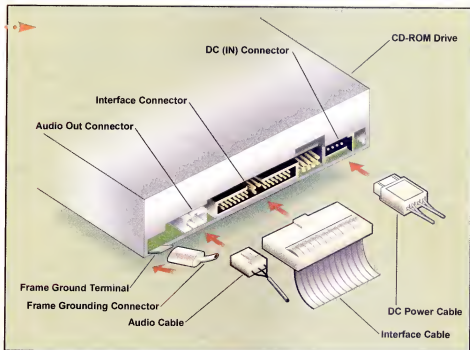
4. After the drive is in place, you will need to hook several cables to it. First, connect the DC power cable to the back of the drive. This cable runs from the computer to the CD-ROM drive

and should be lying just underneath the hard drive. (If the hard drive is in your way, you can loosen the screw that fastens it to the motherboard and pick it up out of your way.) Next, connect the interface and audio cables to the back of the drive. Both of these cables came with our installation kit so don't worry about finding them.

5. Now that you've attached the cables, put the hard drive back in place. Make sure the interface and audio cables run to the other side of the computer but aren't pinched under the hard drive when you put it into place. These cables must run between the CD-ROM and hard drives, not underneath.

6. The installation of the interface board comes next. You'll probably need to locate an empty 16-bit expansion slot, usually found at the back of the computer. (An expansion slot is a socket inside your computer that provides a connection between your machine and the interface board.) To determine if your board needs an 8-bit or 16-bit slot, check the number of connectors on the bottom of the interface board. If the board has two connector areas instead of one, you need a 16-bit slot.

7. Before you can slide the interface board into the empty slot, you must remove the metal plate that covers the opening on the back of the computer. If you find that space is tight when trying to remove the plate's screw,



you can remove the power source located on the right side of your computer (*don't disconnect any cables*). You won't be able to remove the power source completely but should be able to flip it over and lay it on top of the hard drive to get it out of your way. Remove the plate's screw and save it because you will need it to secure your interface board. If you don't have a metal plate corresponding to the slot you have chosen, don't worry. It probably has been removed already for another reason, and you'll just need to find different screws to hold the board in place.

position. If you have to really shove, take the board out and try again.

10. Once the board is in the slot, replace the screw you removed. You shouldn't have to force the screw into place, as the board should stay in position without the screw. The screw simply keeps the board from being bumped out accidentally.

11. Now you'll connect the interface and audio cables to the interface board. You shouldn't have any problem figuring out

we installed our CD-ROM drive, we found that the interface cable ran along the top of the hard drive and would be folded when the case was replaced. It's OK for this cable to be bent underneath the cover. When the case is back on, reconnect the monitor to the computer and plug both in. You can now turn on your computer and begin the software installation.

13. The software installation is easy if you follow the directions in your instruction manual. We only got hung up once, when asked if we wanted to install the software to DOS, Windows, or both. The first time we chose Windows Only, but the computer couldn't find the CD-ROM drive with this choice. So we went through the installation process again, this time choosing both DOS and Windows, and voilà, the installation was complete. The device drivers (which are software programs that let the computer communicate with hardware devices) were installed from the provided diskette so, besides answering some basic questions, we didn't have to do anything during this process.

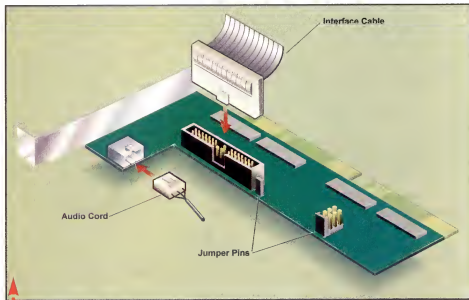
If you've completed the installation and your CD-ROM doesn't work, don't panic. There are several things you can try before running to the phone to call technical support:

- Are all the connections between the interface board, cables, and CD-ROM tight?
- Is the software installed properly?
- Did you put the disc in the drive label side up?
- Are all the settings correct, both on the CD-ROM drive and the interface board?

If you've checked all these things and your drive still doesn't work, call the technical support number listed in your installation manual.

Panasonic's CD-ROM drive was easy to install, and the manual was clearly written. The whole process only took about an hour, as we had no problems that weren't quickly fixed. But don't despair if you can't get your drive to work the first time. Some drives are harder to install than others. Just keep plugging away; the results are definitely worth it. ●

Special thanks to Celine Wishner and Tim Meyerhoff from Panasonic for their help with this article.



8. Your interface board should still be in its shipping wrap. Before you remove the board, ground yourself to prevent static electricity from damaging the circuits. Once again, you'll need to consult your installation guide to make sure the board's jumpers are set correctly. These jumpers look like little black Legos on gold connector pins. As with the CD-ROM drive, these jumpers should be set by the manufacturer on the correct setting and shouldn't require you to change anything.

9. Once you have checked the settings, you're ready to slide the board into the expansion slot. You will need to press firmly to get the board into place. This was the hardest part of the installation because initially we couldn't get the board into the slot. If this happens, push in one side of the board at a time, but don't push too hard. The board should slide in easily once it's in the right

where the interface cable connects because there's only one slot on the board resembling the interface cable. The audio cable may be a little more tricky, as there are three different ends on the cable, enabling it to fit into different slots on different boards. However, only one end will fit into the connection on your board, so you just need to determine which is the match. (See the illustration for step 8 for the location of the cable connections.)

(NOTE: If you were going to install a sound board or already have one, the audio cable would attach to that board and not to the interface board.)

12. Now that you've installed the hardware, you can put the computer's parts back where they belong, tighten loosened screws, and replace the computer case. (If it's a hassle to keep removing the computer case, you may want to leave it off until you make sure the CD-ROM drive works.) When

CPUs Are Central To Your PC

Consider it the brain of your computer. A CPU, or **central processing unit**, is a PC's command center. This tiny chip, made primarily of silicon and about the size of a thumbnail, carries out software commands, performs arithmetic calculations, and communicates instructions to your PC's memory, hard drive, printer, and other peripherals.

Though it's tiny, a CPU is amazingly complex. It's packed tightly with **transistors** (on/off switches), **resistors** (which control the flow of electricity), and **capacitors** (which store electricity). The Pentium chip, which is the latest in the line of CPUs from Intel, the world's largest CPU manufacturer, includes more than three million transistors.

The first CPU, the 4004, was introduced in 1971 by Intel, then an upstart three-year-old company that primarily produced memory chips. Naturally, this chip was primitive by today's standards, offering processing power about 750 times less than today's state-of-the-art CPUs. Intel's 8088 processor was chosen by IBM as the CPU for the first IBM PC. The teaming of Intel and IBM, together with software company Microsoft, led to the personal computer revolution—the widespread integration of PCs in offices, schools, and homes throughout the country.

Intel has had competitors, but it still remains the CPU leader. Over the years, it has introduced increasingly faster processors. Faster chips have more transistors that can carry out more instructions per second. Until recently, Intel usually gave a higher number to each new generation of CPUs. After the 8088 there was the 80286 (usually shortened to 286), the 80386 (386), and the 80486 (486).

Earlier chips required a separate **math coprocessor** chip to speed up the execution of certain mathematical calculations. These math coprocessors carried names such as 8087 (for use with the 8088), 287 (for use

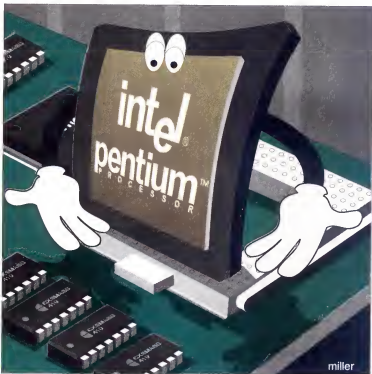
with the 286), and 387 (for use with the 386). With the 486DX chip, Intel included math coprocessing capabilities as an integral part of the chip itself. It also introduced the lower-cost 486SX chip in which these capabilities were disabled.

With the Pentium chip, Intel changed the rules of the game.

■ Pentium

Pentium is Intel's trademarked name for the successor to the 486 series of microcomputer chips. Intel calls its chip the Pentium and not the 586 to differentiate it from compatible chips from such manufacturers as Advanced Micro Devices (AMD) and Cyrix. In the past, these compatible chips included "486" or "386" in their names, just like Intel's chips. Intel was unable to trademark these numerical names, so it gave the verbal name "Pentium" to its newest line of CPUs.

The Pentium follows the 386/486 model and lets you run existing DOS, Windows, or OS/2 applications with it without the need for modification or speed-sacrificing emulation, unlike the PowerPC chip from Motorola, Apple, and IBM.



The Pentium chip is similar overall to its 486 predecessor. There's no quantum leap in capabilities as there was between the 8088 and 286 chips and between the 286 and 386 chips. Like the 486DX, the Pentium includes floating-point capabilities.

The most important difference between Pentiums and 486s is, in a word, speed. The just-released 120 megahertz (MHz) version of the Pentium is rated at 203 million instructions per second (MIPS), compared to the 486DX2 chip's 54 MIPS and the original IBM PC's 0.33 MIPS. (Microprocessors have system clocks that regulate how fast they operate. Megahertz is a measurement of a system's speed in which one megahertz is equal to

one million clock cycles per second.) The MIPS rating is only one measure of a computer's speed—and a rough one at that—but it does indicate how much CPUs have advanced over the past 15 years (see chart for more details).

Compared to the 486 chip, the Pentium also has an internal bus that's twice as large—64 bits versus 32 bits. It has two internal, eight kilobyte (KB) caches, one for data and one for instructions, compared to one 8KB combination cache in the 486. (The bus is the copper tracings on the surface of the **motherboard**, the computer's main circuit board, that transmit data between computer components. An **internal cache** is a group of high-speed memory chips built into the CPU. Data recently used by the CPU is stored here; when data needs to be retrieved, the CPU looks in the internal cache first. Data retrieval from the internal cache is much faster than from random-access memory [RAM].) The Pentium also uses **superscalar architecture** that lets it process two instructions per clock tick instead of one.

Most PCs today come with Intel and Intel-compatible chips. Of the PCs bought in

Processor	Year Introduced	Clock Speed (MHz)	Transistors	Math Coprocessor	Power (MIPS-2)
4004	1971	0.1	2,300	No	0.06
8008	1972	0.2	3,500	No	0.06
8080	1974	2	6,000	No	0.64
8086	1978	5	29,000	No	0.33
8086	1978	8	29,000	No	0.66
8086	1978	10	29,000	No	0.75
8088	1979	5	29,000	No	0.33
8088	1979	8	29,000	No	0.75
80286	1982	8	134,000	No	1.2
80286	1982	10	134,000	No	1.5
80286	1982	12	134,000	No	1.66
386DX	1985	16	275,000	No	5.5
386DX	1987	20	275,000	No	6.5
386DX	1988	25	275,000	No	8.5
386DX	1989	33	275,000	No	11.4
386SX	1988	16	275,000	No	2.5
386SX	1989	20	275,000	No	2.5
386SX	1989	25	275,000	No	2.7
386SX	1989	33	275,000	No	2.9
386SL	1990	20	855,000	No	4.2
386SL	1991	25	855,000	No	5.3
486DX	1989	25	1,200,000	Yes	20
486DX	1990	33	1,200,000	Yes	27
486DX	1991	50	1,200,000	Yes	41
486SX	1991	16	1,185,000	No	13
486SX	1991	20	1,185,000	No	16.5
486SX	1991	25	1,185,000	No	20
486SX	1992	33	900,000	Yes	27
486DX2	1992	50	1,200,000	Yes	41
486DX2	1992	66	1,200,000	Yes	54
486SL	1992	20	1,400,000	Yes	15.4
486SL	1992	25	1,400,000	Yes	19
486SL	1992	30	1,400,000	Yes	25
486DX4	1994	75	1,200,000	Yes	60
486DX4	1994	100	1,200,000	Yes	81
Pentium	1993	60	3,100,000	Yes	100
Pentium	1993	66	3,100,000	Yes	112
Pentium	1994	90	3,100,000	Yes	150
Pentium	1994	100	3,100,000	Yes	166
Pentium	1994	75	3,100,000	Yes	126.5
Pentium	1995	120	3,100,000	Yes	203
P6	1995 (proj.)	133	5,500,000	Yes	250

1. MHz = megahertz

2. MIPS = millions of instructions per second

1994 for home users, for instance, 77% used Intel chips and 13% used chips manufactured by Motorola for Apple Macintoshes, according to the Software Publisher's Association.

PowerPC

This is a new line of RISC (Reduced Instruction Set Computer) chips that are being jointly developed by Motorola, IBM, and Apple. RISC is a fancy way of saying that these CPUs are simpler in design than the CISC (Complex Instruction Set Computer) chips found in most PCs. The PowerPC chip is derived from IBM's RISC

System/6000 chip and Motorola's 88110 RISC processor.

Today, the PowerPC chip is used primarily in Apple's high-end Macintosh personal computers, called Power Macintoshes or Power Macs. IBM is also in the process, though, of developing its own PowerPC-based PCs.

Several PowerPC chips are currently available to system manufacturers or are under development, including the 601, 603, 604, and 620. Like the Pentium, the 601 is a 32-bit chip that uses superscalar techniques for added performance. It runs at 50MHz, 66MHz, 90MHz, or 100MHz, and uses a 32KB combination instruction/data cache.

The PowerPC 603 requires less power than the 601 and is therefore being used in notebook computers. The 604, due out in Power Macs this fall, is a faster version of the 601 and is positioned to be used in standard desktop computers. The 620, which also will be used in systems under development, is aimed at network file servers.

Pentium vs. PowerPC

Apple contends that its new machines incorporating the PowerPC chip—the Power Macs—are faster than IBM-class machines powered by Pentiums. Tests performed by a number of Macintosh magazines support this claim. Not surprisingly, in this brutally competitive industry, tests performed by some PC magazines contradict Apple's claims, contending that Pentiums are slightly faster on most common tasks.

Even PC purists, however, recognize the theoretical advantage of the PowerPC. Its superior floating-point capabilities (used for calculating a large range of numbers quickly) will enhance the performance of future applications written specifically for it, particularly multimedia programs incorporating video and sound. Even today, the Power Mac can be a better choice for image editing, presentations, and CAD (computer-aided design).

Software developers are writing more applications for the Power Mac. But there are many times more software programs for PC-class machines, including Pentiums, simply because there are more PCs being used than Macs. Less than 10% of the PCs shipped last year were

Macs, according to a study by the market-research firm InfoCorp. Having more software choices has always been one of the advantages of owning a PC.

Another PC advantage is price. During the past couple of years, Apple has fallen in line with the rest of the PC industry, dropping its prices to more affordable levels. But even today, some Macs still carry a significant price premium over their PC equivalents. You can buy a bare-bones Power Mac 6100 for about \$2,000, which isn't much more than what you might pay for a 60MHz Pentium PC.

But if you soup the machines up, a Mac can cost well over a thousand dollars more. A

90MHz Pentium with 8MB of RAM, a 540MB hard drive, a 15-inch color monitor, a double-speed CD-ROM drive, a sound card, and external speakers will usually cost about \$3,000. On the other hand, an 80MHz Power Mac 8100 with 8MB of RAM, a 500MB hard drive, a 15-inch color monitor, and a double-speed CD-ROM drive will cost about \$5,000. (Macs come with higher quality native sound systems than PCs, so they don't normally need extra sound components.)

Still, Macs are easier to use than PCs. This historical advantage still holds true, despite the narrowing of the "user friendliness" gap by the Microsoft Windows graphical interface commonly found on PC-class machines.

■ Other Contenders

The Pentium and PowerPC chips aren't the only CPU games in town. AMD is developing its K5 chip, a "fifth-generation" microprocessor compatible with the Intel Pentium. To try to overcome the Pentium's name recognition, AMD will include advanced technology not found in the Intel chip and offer it at a lower price. AMD also has a low-cost line of 486 CPUs.

Cyrix also produces CPUs compatible with the Intel chips. It's working on its M1, which it calls a "sixth-generation" chip that's one level more advanced than the Pentium. Compared with Pentiums, Cyrix contends the M1s will be twice as fast. Like AMD, Cyrix also has a line of low-cost 486s. But Cyrix's biggest claim to fame may be its replacement 486 CPUs. These are designed to replace 386 chips in older machines. The chips are "pin-compatible," meaning that you can pull out the old one and push in the new one—something you can't do with ordinary 486 chips. The 486 replacement chips improve performance, but they don't provide the full power of conventional 486 processors.

There are a number of other CPU manufacturers who focus mainly on the Unix workstation market, including Sun Microsystems, Hewlett-Packard, MIPS Technologies (don't confuse the name of this company with the acronym MIPS, which stands for millions of instructions per second), Digital Equipment Corp. (DEC), Texas Instruments, AT&T, and IBM.

■ Predictions

We're in the midst of a CPU war, with manufacturers waging battle for our hearts,

Are CPUs Buggy?

Intel created a storm of protest late last year when it refused to admit the existence of a bug in its Pentium CPU until it was widely reported over the Internet and then in the media. The bug caused the chip to miscalculate division operations involving certain large decimal numbers.

Intel contended the mistake would occur so rarely as to be a nonproblem—only once in every nine billion operations, which translates to once every 27,000 years for the typical customer. Others, including IBM, felt mistakes could occur far more frequently, as often as once a month.

Initially, Intel refused to replace the defective Pentiums unless customers could prove they were engaged in highly technical computing operations in which there was a reasonable chance for the errors to occur. Many people vigorously protested this

policy, and eventually Intel relented by agreeing to offer replacement CPUs to anyone who requested one. The entire episode, however, was a costly one for Intel—it has set aside nearly half a billion dollars for the CPU replacement program.

Do you have a buggy Pentium chip? One way to tell is to divide 4,195,835 by 3,145,727, then multiply the result by 3,145,727. The result should be 4,195,835, but on the flawed Pentiums, the answer given is 4,195,579. You can perform this test using the Calculator in Windows or with any spreadsheet program.

Though this situation turned out to be a PR fiasco for Intel as a result of its initial reluctance to replace the chips in question, bugs in CPUs are not rare occurrences. Most often, though, they involve only very uncommon operations. ●

minds, and wallets. According to Egil Juliussen and Karen Petska-Juliussen, authors of the Computer Industry Almanac, the winner will likely be the Intel line of CPUs. "It is reasonable to expect that the Pentium and its successors will account for 80% to 85% of microprocessor sales for PCs and other computers," they predict.

In the battle for second place, these industry analysts predict that the PowerPC will emerge ahead of the pack.

Aside from individual winners and losers, the microprocessor industry as a whole continues to grow by leaps and bounds and will likely continue to do so. Worldwide sales of all computer chips increased 28.6% in 1994, totaling \$10.7 billion, according to the Semiconductor Industry Association. Sales of microprocessors have doubled since 1992.

■ Future Trends

Among the more interesting developments to look for in the near future is the incorporation of functions by CPUs that were previously handled by microcontrollers on other devices within a personal computer. Intel, for instance, is working to include multimedia and communications functions directly on the next generation of CPUs, code-named the P6, which is due out in systems this fall.

These plans have inflamed manufacturers of add-in cards, who are afraid that Intel will use its market power to run them out of

business. But Intel contends its new chips will lead to lower prices for consumers, less wasted space inside a PC, and greater energy efficiency.

CPUs-in-progress also will make possible a range of computing activities that are either not possible today or are too slow and inefficient to be of much use. These activities range from speech recognition to full-motion desktop video, and they promise to make personal computing even more exciting than it is today. ●

by Reid Goldsborough

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(408) 732-2400

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(800) 426-2974
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Intel
(800) 548-4725
(408) 765-8080

Motorola
(800) 845-6686
(512) 928-6000

What's At The End Of The Rainbow?

Color Inkjets

The time and effort you've spent in designing a logo for your new small business has paid off—you've got a vibrant design full of attention-grabbing colors. One problem: The logo loses its pizzazz when it's reproduced on your black-and-white printer. Because new technology has forced the prices on many recently released inkjet printers to under \$500, you can give your business logo all the attention it deserves with a color printer.

How else can a color printer help your business? Many color inkjet printers work with overhead transparencies, letting you add color to your business presentations. You can spice up a report by adding a color chart or color cover. If you take all of your color work to an outside printshop, the color printer can give you a preview copy of your work. What parent wouldn't want a printed copy of their child's latest computer art masterpiece? (The unique mixture of colors your child creates wouldn't look quite right taped to the refrigerator if it was printed in black-and-white.)

We'll discuss three color inkjet printers available, as well as some of their benefits and drawbacks. The new generation of low-cost color inkjet printers may not be perfect, but it represents a strong step forward from printing options available just a couple of years ago. If color is what you're after, these printers will yield every color in the rainbow. Don't expect to find the pot of gold at the end just yet, though.

■ Status Of Inkjets

If you're looking to purchase a color inkjet printer, it's probably for one of two reasons. The first (and most obvious) is the color capability. You're probably tired of printing documents in black-and-white. Color documents easily gather more attention than monochrome, or single color, documents. (When you hear the word monochrome discussed in

the context of printing, it usually means black-and-white printing. Monochrome printers use different shades of black to give grays.)

Color inkjets are becoming popular purchases. Sales of Hewlett-Packard color inkjet printers soared 122% from 1992 to 1993, topping the 2 million mark.

"Color is hot," says Carolyn Perrier, Canon Computer Systems' director of peripheral marketing. "Consumers want to enhance their documents with high-quality color easily, quickly, and, most importantly, economically."

The second reason you might be looking at buying a color inkjet is the reduced prices. Many of the color inkjets we'll discuss here have prices less than \$500, which is not much higher than high-quality dot matrix printers or monochrome inkjets.

"For little more than the cost of a monochrome-only inkjet printer, home and business users now have the ability to print in brilliant color," says Aubrey Brickhous, Texas Instruments' director of worldwide printer products marketing.

The initial cost of the printer is only the beginning with color inkjets, however. If you've got a dot matrix printer, you're used to spending a couple of bucks to buy a new ribbon or maybe some paper once in a while. Inkjets require ink cartridges (which usually cost more than \$30 for the three colors of cyan, magenta, and yellow, and anywhere from \$5 to \$35 for black), and some inkjets require special paper. Inkjet printers will yield a higher-quality image when printed on higher-quality paper. Color images usually cost at least 20 cents per page, while black images cost about 3

cents per page. They don't compare favorably to laser printers in printing speed, either. Most color images will take at least three minutes per page to print on an inkjet—an eternity if you're printing a 50-page report—while a similar black-and-white image probably will take about one-sixth of the time.

If you're expecting to be able to reproduce professional-quality photographs on your low-cost color inkjet printer, think again. Most have a resolution of about 300 x 300 dots per inch or dpi, which will produce sharp graphic images and high-quality text printing, but which will produce somewhat rough images of photographs. (Dpi are used to measure the sharpness and clarity of a printed image. The more dots per inch used, the sharper the image. That sharpness is called resolution.) When you see a large gap between prices for printers, the higher-priced printer usually is going to offer higher resolution and faster printer speed, especially if you're sticking to the major name brands. Higher-priced printers usually yield shades of color closer to what you see on your monitor as well. While the



low-cost printers will yield brilliant colors, they may not exactly match the desired shades.

■ Finding Hidden Costs

As you begin shopping around for a color inkjet printer, don't only consider the impressive printing examples stacked next to the printer. They often will be printed on high-quality paper or use color shades designed to

while an illustration, depending on its size and type, could have 10% to 100% coverage. Also find out the average number of pages that can be printed with a cartridge (the black cartridge usually will last longer than the color cartridges), and find out the cost of replacement cartridges, as well as how easy they are to obtain. Knowing how you're going to use the printer before you begin your search will give

The DeskJet 660C color printer offers color copies at 600 x 300 dpi resolution and black at 600 dpi. You can have color copies produced as fast as 1.5 pages per minute, or if you need black-ink copies, they can be done as quickly as four pages per minute.

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low-cost printers will yield brilliant colors, they may not exactly match the desired shades.

■ Finding Hidden Costs

As you begin shopping around for a color inkjet printer, don't only consider the impressive printing examples stacked next to the printer. They often will be printed on high-quality paper or use color shades designed to

while an illustration, depending on its size and type, could have 10% to 100% coverage. Also find out the average number of pages that can be printed with a cartridge (the black cartridge usually will last longer than the color cartridges), and find out the cost of replacement cartridges, as well as how easy they are to obtain. Knowing how you're going to use the printer before you begin your search will give you an idea of whether your ink usage will be

The DeskJet 660C color printer offers color copies at 600 x 300 dpi resolution and black at 600 dpi. You can have color copies produced as fast as 1.5 pages per minute, or if you need black-ink copies, they can be done as quickly as four pages per minute.

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low-cost printers will yield brilliant colors, they may not exactly match the desired shades.

■ Finding Hidden Costs

As you begin shopping around for a color inkjet printer, don't only consider the impressive printing examples stacked next to the printer. They often will be printed on high-quality paper or color shades designed to show off the printer's best features. While it's a good idea to see the printer perform its best work, it's also wise to see the printer when it's having an average performance. Ask the salesperson to reproduce the image on some regular paper (you might need to bring some of your own). Bring a diskette with a few color images similar to those you plan to produce. Such images will give you a solid reference point for comparing printers. If you're producing complex images with numerous shades, you might have to consider a higher-quality printer. If you're only going to print simple color images, the low-cost inkjet printers should fit your needs. If you don't know exactly how you'll be using the printer, bring a range of graphics.

Another good reason to bring graphics created on your computer is to check compatibility. Make certain the printer will work easily with the software you use on your computer. Ask whether special software is required to let the printer accept certain file types, such as PostScript. (PostScript is a type of page-description language developed by Adobe and used in printing images. The page-description language provides instructions to the printer for constructing text and graphics inside the page layout.) Sometimes low-cost printers will require software (costing about \$200) to interact with certain types of files or computers.

The cost of replacing the ink supply is a major consideration for color inkjet printers. A type of inkjet printer you might want to avoid is one without a black cartridge (this usually will occur on a smaller printers). Most color inkjets will contain one cartridge for black ink and one for the three colors (cyan, magenta, and yellow) needed to form any color in the spectrum. Some printers only contain the color cartridge, using 100% density of cyan, magenta, and yellow to create black. This type of printer will consume your inks quickly, especially if you print quite a bit of black text.

The printer manufacturer usually can provide a cost per page estimate, based on a percentage of the paper covered by ink. A general text page will have about a 5% coverage of ink,

while an illustration, depending on its size and type, could have 10% to 100% coverage. Also find out the average number of pages that can be printed with a cartridge (the black cartridge usually will last longer than the color cartridges), and find out the cost of replacement cartridges, as well as how easy they are to obtain. Knowing how you're going to use the printer before you begin your search will give you an idea of whether your ink usage will be higher or lower than average. Let's look at some printers.

■ ExecJet IIc

Lexmark International of Lexington, Ky., has released an inkjet color printer. The ExecJet IIc, which has a suggested retail price of \$349 and a two-year warranty, is aimed toward the small business and home market.

The printer contains a black cartridge and a color cartridge, with resolutions of 600 x 300 dpi for black and 300 x 300 dpi for color. Its letter-quality speed is two pages per minute for black and one page per four minutes for color.

The black cartridge is designed to print 1,000 pages at 5% coverage, while the color cartridge is designed to print 200 pages at 15% coverage. Approximate cost per page for 5% coverage of black is 3.2 cents, while of cost for 15% coverage of color is 19 cents per page. A black replacement cartridge costs \$31.95, while a color replacement cartridge costs \$37.95.

ExecJet IIc

Lexmark International Inc.
740 New Circle Road
Lexington, KY 40511
(800) 358-5835

■ DeskJet 660C

Hewlett-Packard, the world's top seller of inkjet printers, followed their DeskJet 560C color printer with the DeskJet 660C for IBM-compatible computers (or the DeskWriter 660C for Macintosh users). The DeskJet 660C includes a three-year warranty and sells for a suggested retail price of \$599.

The DeskJet 660C color printer offers color copies at 600 x 300 dpi resolution and black at 600 dpi. You can have color copies produced as fast as 1.5 pages per minute, or if you need black-ink copies, they can be done as quickly as four pages per minute.

DeskJet 660C

Hewlett-Packard
5301 Stevens Creek Blvd.
MS511L-SJ
Santa Clara, CA 95050
(800) 752-0900

Lexmark's ExecJet IIc color inkjet printer has an estimated color printing cost of 19 cents per page.



■ BJC-600e

The BJC-600e color inkjet printer from Canon Computer Systems can be purchased for a suggested retail price of \$469, including a two-year warranty. The BJC-600e, whose predecessor was the BJC-600, has a 720 x 360 dpi resolution in black and a 360 x 360 dpi in color.

One of the printer's best features is its no-waste ink system. Each of the four colors (cyan, magenta, yellow, and black) is enclosed in a separate cartridge, meaning if only one color runs out, you can replace the single cartridge. (With other cartridges, cyan, yellow, and magenta are contained in a single cartridge. If one color runs out, you lose any unused portions of the other colors when you discard the cartridge.)

BJC-600e

Canon Computer Systems Inc.
2995 Redhill Ave.
Costa Mesa, CA 92626
(800) 848-4123 ●

The battle between portable and desktop computers is brewing as arguments over which type of computer is better permeate office buildings. As portable computers continue to sport improved features for lower prices, steadily gaining ground on their desktop counterparts, debates over whether you should use a portable computer as your only computer will become more common. Desktops and portables are standing toe-to-toe, and choosing between the two has never been more difficult. For people who have been waiting to use portable computers, though, a difficult choice is exactly what they've been hoping for; it means portables have closed the performance gap.

■ Classes Of Desktops

Desktop computers are stationary because of their bulky size and weight. Most desktop computers consist of four components: the computer case, a monitor, a mouse, and a keyboard. Some desktops will have a monitor connected to the computer case, and some will have a pointing device built into the keyboard.

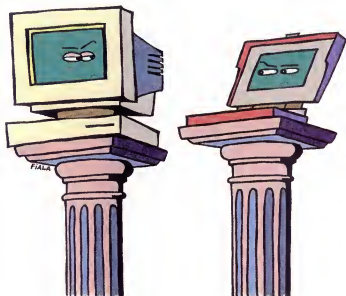
Basically, two configurations of desktop computers are available: a minitower model and a desktop model. The desktop model is a horizontal case designed to rest on your desk, while a minitower model is a vertical case designed to stand upright. Many computer manufacturers will offer these two configurations on otherwise similar machines.

■ Classes Of Portables

Portable computers are those that can be transported easily from site to site, and their components are usually inclusive, with a display screen, keyboard, pointing device, and computer contained in one case.

Portables are available in various sizes. The largest portables you'll probably find today are **laptops**, which weigh 10-20 pounds, depending on their configuration. **Notebook** computers are the most popular type of portable and get their name because they are similar in physical size to a paper notebook. They usually weigh five to eight pounds, and their keyboards will be a little smaller than those found in laptops. **Subnotebook** computers are slightly smaller than notebooks and weigh two to five pounds. **Palmtop** computers, also called **handheld** computers, can be held in one hand and weigh about one pound. Some use a tiny keyboard for

Portables vs. Desktops:



It's A Split Decision

input, while others use a light-pen for writing on the screen.

■ Portables Over Desktops

Of course, the biggest advantage of portable computers, and the main reason people buy them, is their transportability. If you travel or need to work away from your desk, carrying a battery-powered, five-pound computer in your briefcase is easy. Moving a desktop computer from site to site, however, is almost more trouble than it's worth.

Some people use a portable as their only computer, using it on the road and in the office, and here is where the debate lies. Desktops have been the traditional in-the-office computer, while portables traditionally have been used on the road.

With all of the peripherals (add-on hardware devices) now available for portable computers, though, you can achieve nearly the same type of computing power available with

a desktop. You can add a mouse, monitor, extended keyboard, CD-ROM drive, speakers, RAM, modem, and hard drive, among other items, to your portable computer. Many portables use a **docking station** (a base unit that connects to a portable computer to give it added hardware capabilities). The docking station sits on your desk, turning your portable into a desktop when needed.

"People who want to have only one machine, which I think makes a lot of sense, would have a docking station with a big monitor," says Portia Isaacson, president of Dream IT of Colorado Springs, Colo. "A portable can be a person's only machine, there's no question about that. If you can only afford one computer, boy, I'd opt for a portable in a minute, particularly, even though you're going up in price, with the docking station. It's a great way to go."

Isaacson says portable computers are vital to Dream IT, which does consulting for future

product planning and works closely with emerging products. She has been using portables since the company was formed five years ago.

"I'm a really serious user of computers," Isaacson says. "My PC is my right arm. . . . When I go, I must have my computer with me. It's not even remotely possible that I don't take it. I don't even remember how to make a note on a piece of paper. To not have my computer with me, I feel like I'm really handicapped. I take it on every airplane. It's always with me in a client's office."

One key add-on device that allows Isaacson to easily use portable and desktop computers in tandem is a **PC card**, which is a credit card-sized device that plugs into a slot on the computer and gives you access to items like RAM, hard drive space, a modem, or a network. Slots for PC cards are fairly standard for portables, and they're beginning to appear on some desktop models. Isaacson says she saves all of her files on PC card hard disks, making it simple (and time efficient) to transfer files between the computers.

Another advantage is that portable computers give you greater privacy than desktops. Your important files travel with you instead of staying on a desktop's hard drive, waiting for a nosy co-worker to take a peek. Portable computers can be used in cramped and awkward environments, such as in a taxicab or on an airplane. Portables also give you 24-hour access; desktops are available only when you're at your desk. However, achieving portability means sacrificing some usability.

■ Desktops Over Portables

Portable computers usually have smaller keyboards than most desktop computers, which can make them uncomfortable to use (especially for long periods of time). Portables usually contain a pointing device in the middle of the keyboard or a trackball, which will take some adjustment if you usually use a mouse. With today's numerous graphical interface software packages, the pointing device can be one of the most distinguishing features between portables.

Once you are comfortable entering your data, seeing it clearly can be another problem. The display screens used with portables sometimes aren't readable in certain kinds of light or at certain angles, although the quality of the displays is improving. Using an external monitor won't automatically improve your display

because some portables don't contain the proper graphics accelerators.

A few other problems exist, too. Average battery life is about three hours, and you can't buy portable computer batteries off the grocery store shelf. Also, accessing multiple telephone lines or network connections is not possible (yet) with a portable computer.

A few years back, the performance advantages of desktop computers over portables were easy to tally: microprocessor speed, hard drive size, and RAM capacity all were major differences. Now, as advances are made in computing, they are seen in portables just a few months after appearing in desktops. Some advances are made to the two types of computers simultaneously.

Price is the one area where portables continue to lag, but even that gap is narrowing. Portable pricing has improved in part because the market

average, and entry-level models of business and home-use desktop computers within a single brand name, yielding six choices. Most companies offering portables, though, lump business and home-use together and offer only a high-end and an entry-level model, yielding two choices. Another reason is the difficulty most consumers and vendors have in comparing one portable with another. Julian says items like screen size and type, battery life, weight, pointing device, and keyboard placement all make the choice of a portable computer a decision based heavily on personal preference. Likewise, they make pricing decisions difficult. And if you plan to use your portable computer as a desktop computer by adding a keyboard, monitor, and mouse, you'll probably spend another \$300-\$1,000 on top of the cost of the portable.

"Those are things that not only are hard for vendors to decide which to charge more for,

Projected Computer Sales In U.S. (In Millions)

	1994	1995	1996	1997	1998
Total Units	17.1	18.8	20.3	21.6	22.6
Portables	3.4	4.3	4.8	5.1	5.4
Percent of Portables	19.9%	22.9%	23.6%	23.6%	23.9%

Source: International Data Corp.

is demanding more specialization in the brands offered. In 1990, a 386/25MHz desktop cost \$2,000, while a similar portable cost around \$4,000. Now, according to a recent issue of *PC Catalog*, you can purchase a 486DX2/66MHz desktop computer with a 250MB hard drive for about \$1,400, while a similar portable will cost around \$2,000.

"It is a good time, for many reasons, to think about a portable as your one and only system," says Ted Julian, an analyst with International Data Corporation's PC Hardware Program. "Pricing is better than it used to be and the products are more robust. On the other hand, however, as we look at how systems are selling, we're surprised at how price elastic the notebook market seems to be relative to the desktop."

Those elastic, or fluctuating, prices occur because the portable market still isn't as established as the desktop market, Julian says. For instance, most companies will market high-end,

but also no two end-users might agree on those things," Julian says. "There are more tangible differences between notebooks."

■ A Close Call

In today's computing environment, using a desktop computer alone isn't going to be the answer for every business situation. Some people will need the transportability provided by a portable computer, while others need the stability and ease of use found with a desktop model. Some computer users need a combination of the two. Whether that combination comes from two different computers or from a portable connected to numerous peripherals is a matter of personal preference.

One thing is for certain: Portable computers have never before provided the range of choices at the price they're at today, and more improvements are on the horizon. The battle between portables and desktops is too close to call. ●

Dial M For Modem

As the cyberworld gathers press and population, suddenly no computer seems complete without a modem, the device that links your computer to others through standard phone lines.

The mountains of modems in stores and magazine ads attract many users seeking to upgrade their old, slow modems or perhaps to dive into data transmission for the first time. Before deciding which modem to buy, it helps to translate some of that standard computer industry gibberish that shows up on the rows of boxes.

Modem choices are based on three basic issues: whether the modem is going to sit inside or outside your computer, how much speed you need, and how many little extras you want.

■ External vs. Internal

One of the first considerations is where that shiny new modem will live. Nearly every brand and speed of modem comes in two varieties: external and internal. External modems are housed in self-contained boxes that sit on your desk and connect to computers through a cord. Internal modems reside inside your computer with all of their silicon buddies.

External modems usually cost at least \$20 more than otherwise similar internal versions. The additional money buys a couple of advantages. External models are easy to install—you simply plug them into your computer and load up the software according to the manufacturer's instructions. Internal modems also usually have some cool red lights that blink when you send and receive data. Besides being fun to



watch, these lights can help people who know something about modems diagnose any problems that arise.

Internal modems require you to actually open up your computer during installation. Depending on the quality of the manufacturer's instruction manual, this job can be simple or difficult. The main advantages of internal modems are that they cost less and require no additional desk space.

■ Need For Speed

Once you've tackled the internal/external debate, you'll face the Big Modem Question that deals with speed. Depending on how much money you want to spend, you can paddle about the data highway in a slow modem or

shoot the rapids with a fancy fast model. Modem speeds are measured in the number of bits per second, or bps, they can transmit. (Bits are single characters, either 1 or 0, that represent data; eight bits make up a byte, which represents a single character.) It wasn't all that long ago when most modems ran at 2400bps, and a "high-speed" model clocked in at 9600bps. Today, the stakes are higher. The prevailing standard is a 14,000bps modem, and the new 28,800bps modems are quickly gaining popularity.

With a 2400bps connection, it might take a little over a minute to send 20 kilobytes (KB), which is about the amount of information in a five-page text document. (A kilobyte is 1,024 bytes.) A 14,400bps modem could do the same job in 11 seconds,

and a 28,800bps modem would scream through the task in five seconds. These faster transfer rates assume your modem is able to communicate with a modem that can talk at similarly high speeds. A 28,800bps modem can connect with a 9600bps modem, for instance, but data transfer will only move as fast as the slower modem can manage.

Today's modems attempt to reach even faster speeds by using **data compression**. The data doesn't move any faster but is instead squeezed into a smaller form that takes a shorter amount of time to send. Newer 28,800bps modems conforming to the V.34 standard (see sidebar) can theoretically pump data at a blazing 115,600bps, or four times their rated speed. This number, the modem's speed with compression taken into account, is referred to as **throughput**. Many modems boast

fantastic throughputs, but approaching these speeds depends a lot on the type of data in question, the processing power of your computer, and the quality of your phone connection.

A modem's speed is one of the main factors in determining cost. Prices for old, clunky modems are plummeting. Many fast 14,400bps modems are now under \$100, and V.34 28,800bps models usually run \$200 or more. As with anything in computerland, the sky's the limit if you have the urge to spend a lot of money. On the other hand, it's quite possible you don't really need mega throughput.

One way to settle the issue is to think about what you might do with your modem. If you are going to download large files across long-distance phone lines, a fast modem can save you handfuls of money in phone charges. If you are just going to send and receive a few electronic mail messages each day, a superfast modem won't do you much good. Another consideration is the speeds of the modems you want to connect with. The major commercial online services are all adding high-speed connections, but most of them are only in major metropolitan areas so far.

A few people have been known to pick up old 1200bps modems free from friends or some back company storage room. If the price is right, one of these slower modems might be a good way to see if the online world has anything to offer you. The slowest modems you'll find still clinging to store shelves probably run at 2400bps. Although these speeds aren't much for business applications, home users who don't anticipate using their modems for more than E-mail could get by at 2400bps and do nicely at 9600bps. However, with prices dropping every day on much faster 14,400bps modems, it is tempting to take the plunge. A 14,400bps modem—sometimes written as 14.4Kbps—makes it possible to download graphics in reasonable amounts of time. Surfing the Internet's graphical World Wide Web is much more entertaining at high speeds, and you can save money if you pay for online access by the hour.

If 14.4Kbps is good, 28.8Kbps is great—mostly. Just because your modem says it handles throughput at 28,800bps and up doesn't necessarily mean you will see that kind of performance. The 28.8Kbps modems can go too fast for many computers, and they don't work well with Comm.drv, the communications driver supplied with Windows 3.1. After you spend time making your modem and computer

get along, you may find relatively few other 28.8Kbps modems to talk to at the new speed. While 28.8Kbps is the emerging standard, it might not be worth the extra money for the average home user yet unless you plan on frequently downloading large files from sites you know have high-speed modems.

■ All In One

Telephones and computers are slowly merging into one, all-purpose machine. Fax capability or voice support are built in to many modems sold today, giving computer users more options than mere data transmission.

In fact, it's getting hard to find a modem that isn't also a fax. With a fax/modem, you can use your computer to send and receive faxes to and from any fax machine in the world. Unlike with the familiar standalone fax machines, faxes coming into your computer do not need to be printed out. You can view them right on your monitor. You also can send a document or graphic from your screen to a normal fax machine. The fax software bundled with most fax/modems lets you fax to groups of people automatically or schedule transmissions late at night when phone charges are the cheapest (See "Fax Software Anyone Can Love" in this issue.)

Modems with voice capability can, with the right software, receive incoming calls and take voice mail messages for a group of people. Your computer can act as a super answering machine, keeping track of when each call came in, and, if you have caller I.D. service in your area, who made the call.

All of these features—data, fax, voice—can tangle up a single phone line. Some modems are designed to work with the "distinctive ring" feature offered by some phone companies. The phone company can assign one phone line multiple phone numbers, each of which makes a slightly different ring for an incoming call. A fax/modem configured for distinctive ring might answer only the fax calls and let the rest pass through. This is a way for small businesses or individuals to set up their own fax numbers.

Even without all these goodies, a modem can still be an entertaining investment. New features are popping up all over the Internet, online services, and local bulletin board systems that are sure to make your computer less lonely. You even might find something useful out there. ●

by Alan Phelps

The Numbers Game

Modem makers seem to produce as many acronyms and codes as they do modems. Most of the strange numbers on modem boxes refer to the names of industry protocols, or standards modem manufacturers agree to follow to ensure different modems will be able to understand one another.

The main numbers to watch for stand for modem speeds, data compression, and error control methods protocols.

■ Speed

- V.34: The new standard for 28,800bps transmission—a 28.8 modem.
- V.FC: This stands for V.Fast Class, which was one of the more popular interim standards used by the modem industry before V.34 was approved. V.FC modems also run at 28,800bps, but they may not be able to connect at top speeds with every other 28.8 modem. It usually is a better idea to steer toward V.34 rather than of one of these older 28.8 standards.
- V.32 bis: The standard for 14,400bps transmission.
- V.32: The 9600bps standard.
- V.22 bis: The standard for 2400bps modems.

■ Compression

- V.42 bis: Modems that are able to compress data using V.42 bis can theoretically increase throughput up to four times for some files (see main story).
- MNP Class 5: An older protocol that can compress data up to two times.

■ Error control

- V.42: A standard protocol for checking to make sure transmitted data does not contain errors.

■ Fax speeds

- V.29: The standard for 9600bps fax transmission.
- V.17: The standard for 14,400bps fax transmission. ●

Fax Software Anyone Can Love

Graphical applications mean going online has never been easier. That's why millions of people regularly use online services to shop, send electronic mail, or check out the latest software. Since most modems have built-in fax capabilities, you also can send or receive fax transmissions at your desktop. No more time is wasted waiting in line at the office fax machine or retrieving transmissions from the mail room. Moreover, when you fax from your computer, sensitive files remain confidential.

There are other advantages to computer-originated faxes. Documents sent via computer are digitized rather than scanned. They look sharper than printed materials sent from a standalone fax machine. With computer faxing, there's no need for paper, no trays ill-equipped to handle multipage documents, no pages sent upside down or in the wrong order, and no paper jams. Electronic faxes can be printed onto quality paper (if you choose to print at all), and you never run out of paper during transmissions.

While every fax/modem comes with appropriate software for data/fax communications, bundled applications tend to be "plain vanilla" offerings. For example, some lack annotation tools to mark a fax with comments or highlight important text. Also, freebie fax software may not support Optical Character Recognition (OCR). Without OCR, a fax cannot be edited as a text file.

To help you get all the fax, we examined three user-friendly Windows fax packages. These applications were tested on an external SupraFAXModem 288. Each lets you fax directly from any Windows program, and all include phone book-style directories for push-button fax dialing. Only two packages, however, have built-in annotation tools and OCR.

■ BitWare V/F/D, V3.2.4

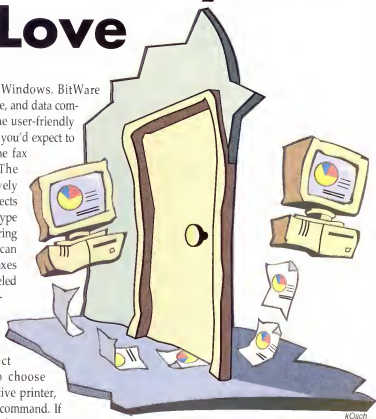
When Cheyenne Communications acquired Bit Software in 1994, it transformed the popular *BitFax* and *BitCom* fax/modem packages

into *BitWare* for Windows. *BitWare* combines fax, voice, and data communications in one user-friendly package at a price you'd expect to pay for standalone fax software only. The program is relatively easy to use. It detects your fax/modem type and COM port during installation. You can send or receive faxes by clicking on labeled icons in the *BitWare* toolbar.

When working in another application, you select *Printer Setup* to choose *BitWare* as the active printer, then issue a *Print* command. If you have *Microsoft Word for Windows*, *Microsoft Excel*, *Lotus Ami Pro*, or *WordPerfect for Windows*, *BitWare* provides special macros enabling you to fax an open document without issuing *Print Setup* and *Print* commands. You must manually activate these macros, however, and it's not always easy to find the directory in which the *BitFax* macro is located.

After activation, *BitWare* places a *Send Fax* button on Word's Standard Toolbar and a *Send Fax* command in Word's File menu. Clicking either fax option produces *BitWare*'s *Dial Fax* dialog box.

During a fax transmission, *BitWare* lets you know the transmission's connect speed, the connect time, and the estimated time remaining in the transmission. You can schedule a fax for a future time and date, keep logs of faxes sent and received, and view a fax either before you send it or after it's received. You also can print a fax or save it to disk in a non-*BitWare* fax format. While you're waiting to receive a fax, *BitWare* lets other software access your system's idle COM port.

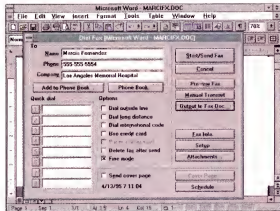


The *BitWare* Phone Book keeps a handy list of fax recipients and their fax numbers. *BitWare* lets you import phone book lists from other applications, as long as files are saved in *dBASE*, *WinFax PRO 3.0*, or *ASCII* format. (The American Standard Code for Information Interchange is a widely used, text-only file format.) A special Phone Book option creates phone book "groups" with names of fax recipients who regularly receive the same fax. When you want to "broadcast" a fax (send the same fax to several recipients), just select the group name from the Phone Book dialog box.

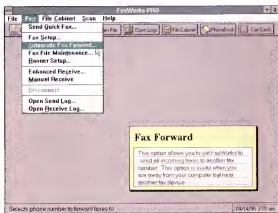
BitWare is convenient, affordable, and functional but not as robust as other fax packages. While you can create a cover page with company logo and signature, you cannot modify a cover sheet design. In addition, you can view, but not annotate, a received fax. Moreover, the current version lacks OCR capabilities, and incoming faxes cannot be converted to *ASCII* text. Furthermore, while *BitWare* automatically recognized our *SupraFAXModem 288* at installation, we were

■ FaxWorks PRO 3.0

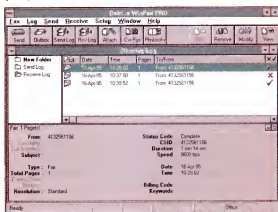
FP comes with several cover sheet templates. These can be customized with a company logo or graphic from the program's clip



BitWare's Macro function installs a Send Fax button, which produces a Dial Fax dialog box, on Word's standard toolbar.



FaxWorks PRO's ease of use comes from Cue Cards, which provide pop-up information about program features.



The multiple window interface in *WinFax PRO* has a busy, and sometimes disorienting, look.

FP's Fax Setup dialog box configures the program's Receive Settings. You can have FP notify you of an incoming fax, print

FP's FaxTracker function provides powerful fax management options. In addition to viewing all faxes sent or received, you can store faxes in special File Cabinet folders for later access. FaxWorks PRO is a program with much to recommend it.

■ WinFax PRO 4.0

Drag-and-drop options let you pick up and move items among WFP folders, groups, or for simultaneous transmission, or send a fax by dragging a faxable item to the Send Fax icon. Attachments may be appended to a transmission by clicking the files you want to send. Faxes can be saved in .TIF, .PCX, .BMP, or .FAX (WinFax native) file format.

Windows Fax Software At A Glance

	BitWare V/F/D V3.2.4	FaxWorks Pro 3.0	WinFax Pro 4.0
User interface	Button toolbars; pull-down menus	Button toolbars; pull-down menus	Button toolbars; pull-down menus
Customizable toolbars			
Context-sensitive online help	✓	✓	✓
Customizable cover pages		✓	✓
Clip art library		✓	✓
Composes cover pages			✓
Integrated macro support for popular Windows word processors	✓		✓
Lets you add your signature	✓	✓	✓
OCR capabilities		✓	✓
Allows preview before sending	✓	✓	✓
Scan command		✓	✓
Annotation and drawing tools		✓	✓
Fax forwarding	✓	✓	✓
Fax broadcasting	✓	✓	✓
Commercial fax mailbox/broadcasting		✓	✓ (optional)

Unfortunately, you pay a space premium for WFP's comprehensive toolkit. A full installation consumes 12.5 megabytes (MB).

During installation, WFP's setup tests COM ports for a fax device, lets you configure the modem for your hardware, and determines whether the modem is properly connected. The whole process, including fax registration via toll-free fax number, proceeded for us without a hitch. When registering WFP, you also can subscribe to two Delrina communication services: Fax Broadcast and Fax Mailbox. Fax Broadcast lets you send a fax to several people with a single phone call. Just send Delrina the fax and recipient list. With Fax Mailbox, your received faxes are stored with Delrina until you're ready to retrieve them. You don't have to leave your PC turned on in unattended mode when you're not around.

You also can have WFP install application macros for Word, Excel, Ami Pro, or WordPerfect. WFP automatically places a WinFax command in Excel's File menu and macro icons for the selected Windows word processors in WFP's Program Manager group. Clicking on a WFP macro icon launches its macro installation. This approach is more convenient than BitWare's macro installation because you don't have to search for the hidden macro file in an application directory. An automatic Remove Macro button is available as well.

Novices will find WFP's multiple window interface less user-friendly than FaxWorks PRO's interface. Though context-sensitive online help is available from anywhere in the program, pull-down menus don't follow the familiar Windows File... Edit... structure. There

are no "cue cards" or function descriptions that appear when the cursor rests on a particular button or command. (You must click and hold the mouse button on an icon for a description to appear.) WFP's interface has a cluttered look. Also, its OCR utility missed more characters than the OCR function in FaxWorks Pro, and users don't have as many file format options for saving converted fax files.

Issues of complexity notwithstanding, WinFax PRO is very flexible. You can customize its toolbars to suit your needs, touch up a fax by erasing or drawing on portions, stamp a fax with a bit map such as "DRAFT" or "APPROVED", forward a fax to another number, and, with a Class 1 modem, even send data files in their original format via Binary File Transfer instead of converting the fax to a bit-mapped image. Intermediate and advanced computer users are sure to appreciate its robust feature set.

Remember that the fax software bundled with your modem lets you get the job done. If your budget is tight and you can live without amenities, stick with the no-frills, bundled package. If faxing is your business, however, or if you just want more control over content and appearance, try one of our big three. ●

by Carol S. Holzberg, Ph.D.

For More Information:

BitWare V/F/D for Windows, V3.2.4
\$99
Cheyenne Software
(800) 243-9462
(516) 484-5110

FaxWorks PRO 3.0

\$99
Global Village Communication
(800) 329-9675
(408) 523-1000

WinFax PRO 4.0

\$129 (with WinComm PRO 1.1 as Delrina Communications Suite 2.1, \$179)
Delrina
(800) 268-6082
(408) 363-2345

System requirements:

BitWare V/F/D for Windows, V3.2.4—Class 1, 2, or CAS-compatible modem; Windows 3.1; DOS 3.1 or newer; 386 or higher CPU; 9MB available hard disk space; 4MB RAM; to use software's voice features or high-speed (faster than 14.4kbps) features with an external modem, you must install a fast I/O card with a 16550 UART chip.

Faxworks PRO 3.0—Class 1,2, or CAS-compatible fax/modem; 386 or 486 CPU; Windows 3.1; mouse; 4MB RAM; hard drive with 5MB available space.

WinFax PRO 4.0—Compatible fax/modem; Windows 3.1; 12MB available hard disk space for minimum installation, 17MB for full installation; 4MB RAM.

Backups

Vital Insurance Against Data Loss

The sky darkened quickly, and the low-hanging clouds seemed to drip with foreboding. When the rain started, Bob Bearn thought he was ready. His seven networked computers, the lifeblood of his business, were protected by uninterruptible power supplies with built-in surge suppressors.

Zap!

In a flash, lightning struck nearby, and a mammoth electrical surge bolted past his carefully constructed shield, destroying one computer and ruining delicate components in each of the other six.

Fortunately, Bearn, who owns an auto repair shop in Warminster, Pa., had taken one further precaution when the storm hit during the summer of 1993. He'd been making daily backup copies of the customer and financial data stored on his computers. With the help of his computer supply company, his business was up and running the next day.

Backing up computer data can be as simple as copying it onto floppy diskettes or as sophisticated as setting up a system where the computer automatically backs up data—without the need for human involvement—onto high-capacity tape cartridges. Some backup strategies even involve running a computer system at another site that duplicates the system whose data you want to protect.

However you back up, what's most important is diligence, says Gerry Stoloff, a computer consultant based in Fairless Hills, Pa., who's been involved with computer disaster planning and recovery for the past 10 years.

After all, it's easier and less expensive to restore backed up data than it is to re-create it from scratch. It costs an average of \$17,000 to re-create 20MB of sales and marketing data, \$19,000 to rebuild the same amount of accounting data, and a whopping \$98,000 to reconstruct this much engineering data, according to a report by the National

Computer Security Association (NCSA).

What's more, re-creating this data can take from three to six weeks, during which time a business can hemorrhage badly. Mark A. Fischer, president of MJF Associates, a data recovery firm in Manassas, Va., estimates that half of all companies experiencing computer downtime lasting 10 days or more will either go out of business or be sold within one year.

Data can be destroyed not only by lightning strikes and other natural disasters, but also by hard drive crashes, software bugs, accidentally erased files, accidentally reformatted disks, sabotage, theft, computer viruses, and fires.

Whether you have a standalone PC or manage a network, there are several decisions a business needs to make in determining the optimal backup strategy: backup media, backup software, and backup procedure.

■ Backup Media

One decision that you must make early in your decision-making process is whether to back up to floppy diskettes or to a tape backup or other system. Backing up to floppy diskettes can be a viable option, as long as you have a small hard drive or don't generate a lot of new data. But with today's business PCs typically using hard drives of 200MB to 500MB, and with network file servers being even larger,

doing the floppy diskette shuffle can become a real chore. Even with data compression, for instance, backing up a full 200MB hard drive can take a whopping 100 1.44MB floppy diskettes.

If you have a hard drive larger than 120MB, you should seriously consider buying a tape backup drive, recommends David Oldfield, director of product management in the Peter Norton Group at Symantec, which markets backup software. If you generate a lot of new data during the course of a week, the same recommendation holds true regardless of your hard drive's size.

As with most other types of computer hardware, the price of tape backup systems have decreased as capacity has increased. The most common tape drives use the QIC-80 format, which uses minicartridges that hold 125MB of uncompressed data or about 250MB of compressed data (backup software can optionally compress data as it backs it up from your hard drive). The drives sell for as little as \$160, and the cartridges sell for about \$12 each. Five years ago, lower-capacity QIC-40 drives, which can hold 60MB of uncompressed data or about 120MB of uncompressed data, sold for \$1,000.

Tape drives are either internal or external. Internal units are less expensive, but they require a free drive bay and can't be used to back up more than one PC. External units, on the other hand, need a separate controller, though



some newer ones can plug into a parallel port and can be used with notebook computers.

Newer formats, designed for today's larger capacity hard drives, have recently hit the market. QIC-3010 drives use cartridges that hold 340MB of uncompressed or 680MB of compressed data. QIC-3020 drives hold 680MB of uncompressed or 1.6GB of compressed data. These newer formats can read cartridges created by older formats as long as the backup software is compatible.

Whereas a QIC tape drive makes sense for a standalone PC or workstation connected to a network, a DAT tape drive is often a better choice for a network file server. Though more expensive, DAT drives are faster and offer higher capacity than QIC drives. They're typically 2GB to 5GB in size and range in price from \$800 to \$3,000 for the drives and \$7 to \$20 for the tape cartridges.

Tape drives may be the most popular high-capacity backup option, but they're not your only option. Removable hard drives and removable cartridges, such as SyQuest drives and Bernoulli drives, make it quicker to get back to work if your primary hard drive crashes, are more convenient for offloading files you're not using regularly, and make better choices than tape drives for exchanging large files with other users. They're more expensive per megabyte, however, than tape drives.

CD-ROM recorders, also called CD-recordable drives or CD-R drives, also can be used for backup purposes. They're particularly useful for creating near-permanent archives of critical data—CD-R discs have a projected lifetime of 100 years, longer than that of other backup media. CD-R drives, which create discs that can be read in conventional CD-ROM drives, also make good choices for distributing voluminous material to employees and customers.

Prices of CD-R drives have been dropping dramatically. Two years ago they sold for \$10,000. You now can find them for less than \$2,000. Blank discs sell for about \$15. A CD-R drive can be an economical backup choice, but, on the negative side, it's the slowest of all the high-capacity backup options.

Still another option is using a second hard drive onto which you can back up data from your primary hard drive. This can be a second hard drive inside your PC's case, it can be a file server for workstations connected to a network, or it can be a file server at another site connected to your file server over a wide-area network (WAN).

A refinement to this approach is to use software or a special controller that mirrors the contents of your primary hard drive—every time you write data to your primary drive, it's automatically written to the backup drive. The relevant acronym here is RAID, which stands for **redundant array of inexpensive disks** (or, according to some vendors, intelligent disks or independent disks).

Disk mirroring provides the fastest way to get back to work if your hard drive or file

server crashes, making it appropriate in mission-critical situations when you can't afford significant downtime. A Gallup study of Fortune 1000 companies a few years ago found that it costs an average of \$5,000 per hour in lost productivity every time a network goes down.

Using another hard drive on-site as a backup medium, whether mirrored or not, shouldn't be your sole backup solution, however. In the event of a fire, flood, or

No Backups?

Take a worst-case scenario: Your hard drive or your network file server crashes, or you experience another disaster that makes it impossible to access your data. You haven't made recent backups, or your backups are bad. What do you do?

If your data is the lifeblood of your business, you'll probably want to do everything possible to recover it. Data recovery firms exist solely to save data that seems to be unrecoverable. These firms can work with various storage media, such as hard drives, floppy diskettes, tape drives, CD-ROM drives, Bernoulli drives, and SyQuest drives.

Data recovery firms use technology that is the computer equivalent of the medical tools used for open-heart surgery. Class 100 clean rooms help ensure that when a technician opens your hard drive, it doesn't get contaminated with small particles of dust. Technicians use custom-built disk controllers, special power supplies, robotics equipment, and proprietary software to do the actual data recovery.

The cost of using a data recovery firm will be from about \$300 to recover data from a small hard drive to \$2,000 or more for a network file server. Much depends on how extensive the damage is and how long it takes to recover the data.

After recovering data, it sometimes pays to replace the failed drive, other times it makes more sense to rebuild it. It's generally cheaper to replace the drive. What's more, new drives are usually more reliable, faster, and use less power than the drives they replace. However, if the drive's electronics, motor, or other electro-mechanical components have to be rebuilt to recover the data, it often pays to finish the rebuilding job.

Data can be returned to you on a rebuilt hard drive, on a new hard drive, on a tape

drive, or on floppy diskettes. Data recovery firms also guarantee the confidentiality of your data. The turnaround can be as quick as two days or even faster if you're willing to pay a premium.

You can maximize the chances of a data recovery firm being able to successfully recover data from a crashed drive by regularly defragmenting the hard drive with a program such as *Norton Utilities* or *PC Tools*. By placing data from files on sectors next to one another, finding one sector makes it easy to find the rest and recover the entire file.

Conversely, using on-the-fly compression programs such as *DoubleSpace*, *DriveSpace*, and *Stacker* can make data recovery more difficult. Likewise, the data recovery features of programs such as *Norton Utilities* and *PC Tools* also can cause problems, says Michael Rogers, CEO of Ontrack Data Recovery, a data recovery firm in Eden Prairie, Minn. These programs can be life-savers if your drive has logical problems. But don't use them if you suspect an electrical or mechanical drive failure, warns Rogers. He says these programs, if used incorrectly, can lessen the chances of recovering data. ●

For More Information:

Ontrack Data Recovery
(800) 872-2599
(612) 937-5161

Lazarus Data Recovery
(800) 765-9292
(415) 495-5556

MJF Associates
(800) 544-3282
(703) 369-6535

other disaster, the data on your backups would be destroyed along with the data on your hard drive.

■ Backup Software

Your next choice is backup software. MS-DOS 6.0 and newer includes a backup program called Microsoft Backup. If you back up to floppy diskettes, it may be all you need. Its major shortcoming, however, is that it doesn't support tape drives. Microsoft Backup is based on an earlier version of Symantec's *Norton Backup*, which—in earlier versions and the current version—lets you back up to tape as well as provide faster backups to floppy diskettes.

Virtually all tape drives include backup software, which also may be based on Norton Backup or another third-party backup program. The included software may be all you need. It can be advantageous, however, to buy a standalone program to take advantage of automated features or an easier-to-use interface. The two market leaders are Norton Backup for Windows and Fastback Plus for DOS, which each have list prices of \$149. (*Norton Desktop for Windows*, a popular replacement for Windows' Program Manager and File Manager, includes a complete version of Norton Backup for Windows.)

A new product, *Norton Enterprise Backup*, is designed to make backups easier for LAN administrators. It lets you back up the file server and individual workstations from a single location over a LAN or WAN. You pay for the convenience, though—Norton Enterprise Backup has a list price of \$1,095 for a single server plus \$66 per node.

■ Backup Procedure

The next decision involves frequency and type of backups. You should determine the frequency of your backups according to how much data you can afford to lose. One common strategy is to do full backups every week and incremental or differential backups every day or two.

An **incremental backup** involves backing up only those files that have changed since your last backup. It takes less time than a full backup but uses more tapes and, because of this, it can be more difficult to restore from the backup tapes. A **differential backup** is similar, except that identical files overwrite themselves instead of being added to the end of the tape.

Regardless of what backup options you choose, it's a good idea to keep at least one set of backups off-site. Fires, floods, and other natural disasters can destroy not only the data on your hard drive, but also your backup tapes or other backup media. It's also wise to keep backups you store on-site secure, in a locked file cabinet or safe. It would be relatively easy for someone to slip a tape cartridge into his or her pocket and walk off with your business.

Any time you make significant changes in your system, make two backups, advises John Dearing, the system operator of the bulletin board system run by the Philadelphia Area Computer Society (PACS). Dearing learned the value of multiple backups several years ago when he was doing a software upgrade. The files on the hard drive were inadvertently trashed, and though he

had a backup, the backup was bad. PACS and its members lost more than 45MB of files they had previously uploaded.

Now, with multiple backups, on-site and off, Dearing can rest assured that the data he's responsible for is secure, which is what backing up is all about.

Tape cartridges are relatively inexpensive, so it makes sense to retire them after about a year, at least for the purpose of backing up crucial data. You still can use older tapes, though, for archiving applications and data that's not central to your business. Restoring an application that's become corrupted on the hard drive is faster than reinstalling it from scratch.

To maximize the efficiency and minimize the pain of backing up, use the scheduler feature that comes with most backup software. This lets you specify a time each day or week

when the backup software automatically kicks in. You don't have to be present, but you will have to leave your PC turned on.

Beforehand, however, consider disabling any screen savers (including the ones built into Windows). When a screen saver is active, the backup procedures will run very slowly in the background. Using the compression feature of your backup software also will speed things up, along with letting you back up more data on fewer cartridges.

Regardless of which backup approach you choose, it's a good idea to make several practice runs with it, advises Bennett Landsman, manager of network planning and system integration for New Jersey's Department of the Treasury.

"You want to make sure your system works and that you know exactly what to do ahead of time," he says. "There's nothing worse than learning how a backup system works after a crash, when you're under a lot of pressure." ●

by Reid Goldsborough

For More Information:

Colorado Jumbo 700
Colorado Memory Systems
(800) 810-0133
(970) 635-1500

Imega Zip Drive
Imega Corp.
(800) 697-8833
(801) 778-1000

Gear for Windows
Elektroson
(800) 606-6116
(610) 617-0850

Norton Backup for Windows
Norton Enterprise Backup
Symantec Corp.
(800) 441-7234
(503) 334-6054

Fastback Plus for DOS
Symantec/Fifth Generation Systems
(800) 873-4384
(504) 291-7221

PKZip (compression software)
PKWare
(414) 354-8699

Making Your Keyboard Right For You



In a world where customization has become an important feature in computers, Microsoft Windows has developed a way for you to adjust your keyboard's settings to fit your needs. Although Microsoft is only in the beginning phases of keyboard customization, the company has developed ways for you to adjust keyboard letter repeat rates, mouse controls, and even the keyboard's language.

When computers first came out, it was always the user who had to conform to the computer keyboard. Although this is still partially true, users are now able to make certain adjustments to the keyboard to make their computer more user-friendly. With repeat rates and mouse controls, adaptability seems to be what Microsoft was looking for. Although some people may never feel the need to adjust these keyboard functions, those who do make adjustments will notice a definite difference in the way the keyboard operates.

Customizing Repeat Rates

Microsoft Windows lets you adjust the keyboard repeat rate (how fast a key repeats when you press and hold it down) and the delay before first repeat (how long it takes the computer to repeat a character after you press and hold the key down). To adjust keyboard repeat rates:

1. Choose the Main icon from Program Manager.
2. Click on the Control Panel icon.
3. Choose the Keyboard icon in the Control Panel.
4. Adjust the Delay Before First Repeat by dragging the scroll box toward Long or Short, or use the right or left arrow key.
5. Adjust the Repeat Rate by dragging the scroll box toward Slow or Fast, or use the right or left arrow key.
6. To test either adjustment, click on the test box and press and hold any key.

If you type quickly, a fast repeat and shorter delay rate are probably best for you. People who tend to leave their fingers on the keys may want to choose a slower repeat and longer delay rate to avoid having a single letter typed across their screen.

Adjusting The Mouse

You also can adjust your mouse's tracking speed (the rate at which the pointer travels across the screen) and the double-click speed (the rate at which Windows registers a double-click). To make adjustments to the mouse:

1. Choose the Main icon in Program Manager.
2. Click on the Control Panel icon.
3. Choose the Mouse icon in the Control Panel.
4. Adjust the Mouse Tracking Speed by dragging the scroll box toward Slow or Fast, or use the right or left arrow key.
5. Adjust the Double Click Speed by dragging the scroll box toward Slow or Fast, or use the right or left arrow key.
6. To test your mouse's new double-click speed, click on the test box and click the left or right mouse button.

Your mouse's double-click and tracking speeds are more or less a matter of personal preference. The adjustments depend upon what you are most comfortable with.

Changing The Keyboard's Language

In today's multilingual society, it is sometimes necessary to compose documents in other languages. Using the international keyboard settings in Windows can help you with this task. Through the International icon in the Control Panel, you can change the keyboard's language, layout, and measurement, as well as the keyboard's numbers, dates, times, and currency values. Windows is equipped to accommodate more than 10 languages in 24 countries.

Since different countries use different keyboards, it is important to note that some keys will be disabled when changed to certain languages. When changing keyboard languages, you must have Disk 2 of the Microsoft Windows for Workgroups program inserted in the A: drive. To change your keyboard's language:

1. Choose the Main icon in Program Manager.
2. Click on the Control Panel icon.
3. Choose the International icon in the Control Panel.
4. From the International menu, you can change the country, language, keyboard layout, and measurements. To make changes, click on the down arrow to the right of the option you want to change. This will pull down a menu containing possible choices.
5. After you choose a country, the measurement, list separator, date, time, currency, and number options will change automatically to fit the country. If you wish to change any of these options, click on the Change box and type in the appropriate format.

Note that changing the computer's language will not change the keys on the keyboard. It is best to leave the Keyboard Layout set as U.S./International. This leaves most keys where you would expect and lets you use the ALT key on the right side of the spacebar with certain characters to change to international characters. ●

by Corey Russman

"Big Blue" Is Back

If you know anything about the history of personal computers, the company name you immediately associate with PCs is IBM. But, if you're like most people, when you shop for a PC in today's marketplace, you look at Compaq, Packard Bell, Toshiba, Gateway, and any other brand you can get your hands on. IBM basically created the personal computer revolution in the early 1980s and dominated the marketplace but, somewhere along the line, lost its market leadership position and was shuffled back into the PC pack.

IBM clones, usually called IBM-compatible computers, now split the majority of the market share. IBM has rededicated itself to regaining a solid market share, though, and "Big Blue" is making that move behind computing innovations.

Such innovations are most easily seen in the portable computer industry, where IBM has developed a number of design improvements to set its ThinkPad line apart in the sea of clones. The largely hyped, new Butterfly ThinkPad is one such innovation. But IBM is in the process of making large pushes in desktop computing, operating system software, and communications software as well. We'll discuss the upgrades IBM has made and give you an idea of where IBM is headed.

■ New Attitude

IBM is a unique computing company because it has a hand in nearly all major aspects of the computing world—desktop computing (with the Aptiva), portable computing (ThinkPad), operating system software (PC DOS and OS/2 Warp), and, now, general productivity software. IBM recently completed a takeover of Lotus Development Corp., maker of *Lotus Notes* and *Lotus cc:Mail* among other highly successful software packages.

Even though IBM is involved in a wide variety of computing markets, IBM isn't

considered the leader in any of them.

In recent months, though, IBM has made a large push to establish itself as a major component in all of those markets, through major innovations and strong television advertising campaigns.

"There's definitely a strong focus on the PC market by IBM," says IBM spokesperson Jonathan Gandai. "IBM does intend to lead the PC marketplace, and it's focusing itself on that goal.... Clearly the focus now is to very closely correlate the two sides, and to make sure that we're offering the best total solution, a total hardware/software package."

■ ThinkPad

The portable computing market is where IBM perhaps has made its biggest inroad.

"In 1992, in the first half of the year, if you were to look at a pie chart of the mobile marketplace, you wouldn't have seen IBM," Gandai says. "You wouldn't have seen IBM listed with whatever number of companies were in that little sliver called 'other.' IBM panned out to be about No. 12 in mobile market share. And since there were only so many companies making mobile computers back in

1992, you figure No. 12 was pretty far back in the pack. IBM had not focused itself on that market. When IBM started planning the ThinkPad line, which was introduced later that year, that was when IBM focused on the mobile market.... IBM, depending on what consultants you talk to, now will be listed as either No. 2 or No. 3 in (portable) PC shipments, and that's only in about (two or three) years from No. 12."

Gandai says IBM has accomplished its market surge through innovations in its ThinkPad line. Here are the major ones.

Display screens. The screens on the ThinkPad computers are among the clearest and largest available in the portable computing market. IBM has consistently maintained a 10.4-inch screen (measured diagonally) on its ThinkPads.

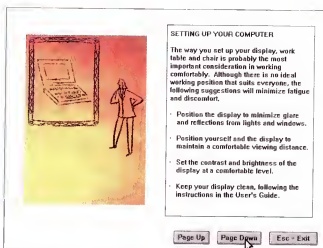
"You have seen in the last about six months other PC makers starting to integrate 10.4-inch displays," Gandai says. "That's an area that you will continue to see IBM innovating on in the future. We'll definitely continue to lead in that area.... The other thing



we did to screens, in addition to the size, was the introduction of anti-glare technology, which we call Black Matrix. That is something you may see more people in the market doing in the next year or so. It's great for when you're either outdoors or in some office setting with neon lighting where you tend to get a lot of glare on your screen."

Pop-up keyboard. The TrackWrite keyboard, which we'll discuss later, has gotten the most attention, but it wasn't IBM's first innovative keyboard design for portable computers. The pop-up keyboard, which is available on full-size ThinkPad notebook computers, lets you interchange various internal components.

The entire pop-up keyboard lifts up, revealing the ThinkPad's battery, hard drive, and diskette drive. You can remove the diskette drive and insert another module to handle a particular task, such as wireless



IBM's computers always feature strong online help features.

communication, additional PC Card slots, or a television tuner. Each of the modules can be removed by hand easily.

"The idea there was to emulate a briefcase so that people who aren't proficient with computers wouldn't really have to worry about how you upgrade or how you add a capability to your machine," Gandal says. "You would simply do what you do when you

leave your office: Unzip the briefcase, take out what you don't want, stick in what you want, and go."

TrackPoint. The TrackPoint pointing device, which is similar in looks to a pencil eraser, was introduced with the ThinkPad in 1992. The latest version, the TrackPoint III, offers QuickStop, which anticipates you stopping the pointer arrow on an icon or button, helping you use the pointing device more efficiently. A special, removable grip on the TrackPoint III makes the pointing device slip resistant.

The TrackPoint is located between the G and H keys in the middle of the keyboard, with the selection buttons located under the space bar. The TrackPoint's central location makes it usable for either left- or right-handed users.

When the TrackPoint was introduced, Gandal says, "there were a lot of other solutions that were basically clip-on trackballs that always had to go on one side of the machine or trackballs that were embedded

The ThinkPad Spreads Its Wings

When you initially see the ThinkPad 701 model notebook computer from IBM, you have to wonder when IBM began hiring magicians as computer designers. How else can you explain squeezing a full-size keyboard into a subnotebook shell?

Once you actually type on the keyboard and realize you're not viewing an illusion, one word clearly describes your feelings about the 701.

"When we first showed that product, whether it was to customers or consultants, the people would just say, 'Wow!' and would ask if we could just keep opening it and shutting it, because no one could believe it," IBM spokesperson Jonathan Gandal says.

■ Butterfly

The 701 has generated plenty of excitement in the portable computing world, grabbing the covers of many magazines devoted to portable computing. IBM has been hard pressed to keep pace with requests for evaluation units from various media. We cajoled,

begged, and pleaded with IBM for three-plus months before finally receiving an evaluation unit for this story.

What's all of the fuss about? The puzzle-like keyboard called the TrackWrite.

The TrackWrite is actually a two-piece keyboard that fits within the dimensions of the 701's case when the computer is closed. But when you lift the 701's lid, the keyboard's pieces slide together and out, extending about one inch beyond the sides of the computer case. The keyboard automatically locks into place when the computer is open; it automatically splits and returns to its resting place when the computer is closed.

The TrackWrite is easy and comfortable to use. When extended, it actually is bigger with larger keys than keyboards on full-size notebooks we've used. It's an innovation that's been a long time coming in the subnotebook market.

■ Solid Computer

The 701 is much more than a fancy keyboard, though. It is an impressive computer, featuring a

desktop-quality screen as well as amazing sound capabilities. The impressive screen and audio are evident immediately when you turn on the computer through a multimedia introduction program. You won't believe the sound capabilities of the 701, which are the best we've ever seen on a portable computer without using external speakers. The screen is as large as it is clear, measuring a full 10.4 inches diagonally, which is as large as you'll find in a portable computer.

The 701 has dimensions of 9.7 x 7.9 x 1.7 inches and weighs 4.5 pounds, making it a solid portable option. You can get the 701 with either a 486DX2 or 486DX4 microprocessor, 4MB or 8MB of RAM, and 360MB to 720MB hard drives.

The software collection available on the ThinkPad is unmatched. You can choose or switch between Microsoft Windows and IBM's OS/2 Warp for operating systems. Various communications, productivity, fax, online service, and audio software packages are included with the 701.

only in one side of the machine itself." "None of those were solutions that people really were pleased with . . . Of course, you do see a lot of pointing sticks out there now. Those are not all TrackPoints. Some of them are legitimate TrackPoint licensees; most of them are knockoffs. None of them are TrackPoint III."

TrackWrite. The TrackWrite keyboard is one of the hottest innovations to hit the portable computing industry. It's only available on the ThinkPad 701 model, nicknamed the Butterfly. (See "The ThinkPad Spreads Its Wings" for a review of the newest ThinkPad.) The two-piece keyboard automatically slides together to form a full-size keyboard in a sub-notebook shell when you open the computer lid. While the TrackWrite seems like an obvious idea, it was one that eluded portable computing engineers for years.

"No one had been able to come up with anything better than making a 90% size keyboard and hoping that that was large enough," Gandal says. "(An IBM) designer was at home, watching his daughter playing with building blocks, and when she started

moving the blocks around in different directions, a light went off. He ran into the office, and that morning he took a ThinkPad, he opened it up, he put the keyboard down on a Xerox machine, and he (copied) it. Then he took a scissors and cut the keyboard in different directions and angles. What he found was that, actually, you could take the keyboard, cut it in two horizontally, and put one side above the other. The depth was still the depth of a small notebook. You could fit it all in there, and if you developed the mechanism to slide it out, that was going to be the easy part."

■ Innovations

IBM will continue to focus on making innovations in the PC market, Gandal says. Innovations carry two benefits. First, they make for an improved product. Secondly, they generate excitement and attention for a product, and the manufacturer's entire line of products receives a boost because of the single innovation.

"You really want to be differentiated in some way," Gandal says. "Most products

and most brands out there are not differentiated. People shop and they look at the price points. What we're providing is another reason to take a close look at what you're buying."

IBM's successes in the mobile market aren't too surprising, Gandal says, because the mobile market is the most receptive to change and innovation.

"There's definitely a strong focus on the whole PC market by IBM," he says. "It just so happens that ThinkPad is probably the best example because, frankly, in mobile, a company with the resources and depth in the labs that IBM has is able to differentiate itself more. The mobile market lends itself more to innovation and design, (while in) the desktop market, that doesn't quite sell."

Whether such innovations will sway computer users into rekindling their IBM loyalty remains to be seen. One thing is for certain, though: The words "IBM" and "personal computing" are once again approaching the symmetry they enjoyed in the early 1980s. ●

by Kyle Schurman



The ThinkPad 701's two-piece, TrackWrite keyboard slides together to become a full-size keyboard when you open the computer's lid.

The 701 contains a built-in infrared connection, an integrated 14,400bps fax/modem (containing answering machine and speaker phone functions), and two PC Card Type II slots. Depending on your computing power needs, the ThinkPad's battery life is two to seven hours.

A high price is about the only drawback to the 701, and even that has undergone a large reduction since the 701 was introduced

in March. Depending on features, the 701 now ranges in cost from \$3,199 to \$4,499, down about 20% from initial prices. With all of the features you'll receive, the ThinkPad's price is on the low end when compared to other high-end portable computers.

■ Taking Off

After reviewing the ThinkPad, we're convinced IBM has created an innovation with the TrackWrite keyboard that may forever change the portable computing market. The two biggest complaints about

subnotebook-size computers are keyboards and screens that are too small for comfort, and the 701 eliminates both.

"The challenge was there," Gandal says. "If you look at the subnotebook market, in which all of the consultants were predicting great growth, you can see from the slow growth that a problem had occurred. While end-users loved the (subnotebook's) size and weight, they didn't want to give up the comfort of a full-size notebook. There was a definite question of how to overcome what seemed to be an impossible challenge: How do you fit in capabilities that physically must be larger than the package itself? . . . This was one where it was a physical design statement that no one had been able to visualize, therefore, no one was able to predict when it could ever happen, and that's what really made it very exciting."

IBM has silenced such complaints with the ThinkPad. It is exactly what a portable computer should be—light, small, and as usable as a desktop computer. ●

Maximizing Your

Windows makes printing easy. Unlike DOS programs, you can use any Windows font with any Windows program. What's more, once you install a **printer driver** (a software program that acts as an intermediary between Windows and your particular printer), all Windows programs can use that driver.

Still, there are steps you can take to make the most of your printing from within Windows. Here's a rundown of points to keep in mind.

■ Speeding Up Printing

Printing from Windows can sometimes make you grind your teeth as you wait for pages to emerge from your printer. Fortunately, you can optimize printing performance by applying these procedures separately, though some can be used together. Experiment with them to see which work best for you.

- Use Print Manager and set the priority setting to high. Print Manager is a print spooler that comes with Windows, and among other things, it enables you to print documents in the background while you continue to work on your computer. Whenever you do background printing in Windows, your PC's central processing unit (CPU) is doing double duty. Therefore, the speed of your application programs will slow down.

Background printing in Print Manager has three options—Low Priority, Medium Priority, and High Priority. Low Priority, as its name implies, gives low CPU priority to printing and high priority to your other programs. This means print jobs take longer, but it causes the least amount of slowdown in your programs. High Priority does the reverse; it assigns more CPU time to Print Manager, which speeds up printing but slows down programs. Medium Priority is a middle ground in which your CPU is divided as equally as possible between Print Manager and your other programs.

To use Print Manager, double-click on Control Panel in the Main program group, open Printers, and check the box next to Use Print Manager. To set Print Manager's options, go back into Control Panel and double-click on the Print Manager icon. Under the Options menu, make your selection.

**Printing from
Windows can
sometimes make
you grind
your teeth.**

- Disable Print Manager. Open the Control Panel, double-click on Printers, and make sure there's not an X in the box next to Use Print Manager. This will speed up printing even more than setting Print Manager to High Priority. It will, however, slow down overall system performance while the print job is printing, and it will prevent you from taking advantage of other features of Print Manager.

Along with background printing, Print Manager also lets you direct printing to single or multiple printers, change the order in which documents print, schedule when documents print, and restart the printing of a document from any page.

- Reduce your dots per inch (dpi) printer resolution. You can do this with some printers by double-clicking on Control Panel, opening Printers, and choosing Setup for your printer. This is more appropriate for draft documents or other documents that you won't show anyone else.

- Use built-in printer (device) fonts instead of TrueType fonts. (TrueType, or scalable, fonts can be printed or displayed on-screen at any size.) Windows comes with a selection of TrueType fonts while many printers come with their own fonts. When choosing a font from within an application, you'll be able to tell the difference by looking at the icon before the font's name. Printer fonts have a printer icon to the left of the font name while TrueType fonts have a TI icon next to the name.

Printer fonts are generally less flexible than TrueType fonts, and if you use printer fonts,

your output may differ from what is shown on-screen. But they can speed up printing.

If you have a PostScript printer, using printer fonts in place of TrueType fonts also can use less printer memory. To change to printer fonts:

1. Open the Control Panel, and double-click on Printers.
2. Select the printer, and press Setup.
3. Choose Options, then Advanced, and check the box next to Use Printer Fonts for all TrueType Fonts.

With dot matrix printers, TrueType fonts print only in the graphics mode of the printer. Because most dot matrix printers can only print graphics in **near-letter quality (NLQ)** or **letter quality (LQ)** mode, draft (text) mode isn't available when printing a document with TrueType fonts. (Documents printed in letter quality look similar to those from a typewriter instead of being printed from coarse dots.) Therefore, using a TrueType font can slow down printing significantly. Using a built-in printer font, in this case, can be a good move. (See the sidebar "Managing Your Fonts.")

- Make sure the TEMP directory setting ("Set Temp") points to an existing directory in your Autoexec.bat file. In addition, make sure that the TEMP directory is not cluttered with old, unused temporary files; periodically delete those that are left there.

For better performance, the TEMP directory should be located on an **uncompressed** hard drive (a drive not compressed with *Stacker*, *DoubleSpace*, or similar programs).

- Make sure your printer is connected to a parallel port in your computer, not a serial port. Parallel ports can carry much more information than serial ports and reduce printing time. Almost all relatively new printers come with parallel port interfaces, as do all PCs.

- Update your printer driver, if possible. Check with your printer's manufacturer to see if they've released a new driver since you bought the printer. Newer drivers not only improve speed but also eliminate bugs in older drivers.

- Increase your laser printer's random-access memory (RAM). This will let the printer stack pages in memory before it prints them, which not only speeds up printing but also lets you get back to work on your computer faster. You can buy printer RAM from your printer's

Printer's Performance

manufacturer, and you often can buy it less expensively from third-party dealers as well.

- Use a third-party print spooler. Print Manager does a respectable job with this, but third-party print spoolers do a better job. Print spoolers, such as *PrintCache* from LaserTools and *PrintQ* from Software Directions, slow down applications during background printing less so than Print Manager.

- Use *Microsoft Windows Printing System*. This is an option if you have one of the supported laser printers from Hewlett-Packard, such as the LaserJet Series II, IID, IIP, IIP+, III, IIID, and IIIP.

Windows Printing System is a combination of software and a cartridge that fits into a slot in the printer. The software includes 79 TrueType fonts, the same fonts that are included in *Microsoft TrueType Font Pack* and *Microsoft Hewlett-Packard Font Set*. Each of these software packages are available separately.

Though extra fonts are included, Windows Printing System's main benefit is increased speed. The

increased performance is a result of the product's ability to directly use the graphic device interface (GDI) of Windows, rather than going through the time-consuming step of translating information from GDI to Hewlett-Packard's PCL printer language. Windows Printing System also optimizes throughput by balancing the processing load between the printer and the PC.

In addition, the software provides an interface that helps you control your printer from your PC. Through its status window, Windows Printing System alerts you to current errors, such as paper jams, and even future errors, such as low toner. You also can see how many pages have been printed, how many are left to print, and the estimated time left to complete the job. You even can manipulate such things as

duplexing, collating, paper size, page orientation, print resolution (from 150 to 300 dpi), contrast, brightness, type of halftoning used, and scaling of images up or down from 10% to 400%.

Windows Printing System is best used on a standalone, rather than a network. You'll still obtain the performance benefits using it over a network, but you won't be able to use the control features.

Chicago
Courier
Futura
Geneva
Helvetica
Monaco
New York
Palatino
Stone Sans
Συμβολ
Times



■ Maintenance

Increasing the speed of print jobs can be a real convenience, but it won't help if your printer goes on the blink. Maintaining your printer properly will help ensure it prints attractive output when you need it, whether you're printing from Windows or any other operating environment.

The manual that comes with your particular printer should list specific maintenance steps you should take, but here are some general pointers.

- Use a dust cover when the printer isn't in use. Avoid smoking around the printer. Keep the humidity moderate in the room where your

printer is situated; too much moisture in the air can cause paper jams or faint printing. Allow air to circulate around the printer by keeping it some distance away from books and other items. Remove dust, small scraps of paper, and other debris from inside the printer with a small vacuum cleaner or can of compressed air.

- Use only the paper recommended by your printer manufacturer; stock that's too thick can cause paper jams. Some envelopes and labels not specifically designed to be used in laser printers, which run very hot, can melt.

- If you're connecting two printers to one parallel port with an A/B switch and you have a laser printer, tread carefully. (An A/B switch

is a device that lets you use two printers over the same serial port.) Using some A/B switches can ruin the delicate internal controllers inside laser printers and also void the printer's warranty. Check with your printer's manufacturer to see if they recommend particular brands of switch boxes that work well with your printer.

- When moving a laser printer—either across the office or across the country—always remove the cartridge first. Spilled toner not only causes a mess but can fuse to rollers, belts, and other surfaces, causing permanent damage. If toner does spill, use a small vacuum cleaner to suck up as much as possible, then wipe the rest with a dampened soft cloth.

Managing Your Fonts

Among the many benefits that Windows brings to users is the ability to use the same fonts with every Windows application. Before Windows 3.1, you had to buy a separate font management utility, such as *Adobe Type Manager* or *Bitstream FaceLift*, to be able to print a selection of high-quality fonts at various sizes, whether you were using a dot matrix, inkjet, or laser printer.

Windows 3.1 introduced TrueType to the PC world. TrueType is a font system that's tightly integrated into Windows itself, which makes using it nearly effortless. Among other things, you can view the same fonts on-screen that you'll see on your printed pages, a feature known as WYSIWYG (What You See Is What You Get). The success of Windows and TrueType in the marketplace has led to a dramatic increase in the availability of all kinds of fonts and an equally dramatic decrease in their price.

TrueType fonts are available from Microsoft, Bitstream, Monotype Typography, Agfa Compugraphic, Micrologic Software, Swift International, and Atech Software, to name just a few companies, as well as from numerous shareware vendors. You often can find a rich collection of shareware fonts at your local computer users group or online from a computer bulletin board system (BBS). Many of the display shareware fonts are of surprisingly good quality, though the text fonts may not be as good as those from commercial font foundries. TrueType fonts also are included in a number of software

programs. The latest version of *CorelDRAW*, for instance, includes a whopping 825 fonts.

This easy access to a large number of different fonts can lead to a cluttered machine, slowing down your system. A number of software solutions have emerged to help you manage all Windows fonts. *Font Works Express*, for instance, is a program that lets you organize your fonts into groups and selectively enable and disable the groups, depending on your needs. The program also comes with 70 TrueType fonts. *Microsoft TrueType Font Pack 2* comes with Font Assistant, a utility program that provides similar features.

Even without a font management program, you can selectively remove any fonts you don't need manually. To remove TrueType fonts, double-click on Control Panel, then open Fonts. Select the fonts you want to remove, then click Remove. Windows will give you the option of temporarily disabling the font or removing it from your hard disk.

Temporarily removing fonts can speed up your entire system if you have a large number of fonts installed. It prevents Windows from loading the fonts when you start it. Removing a font from your hard disk can speed up Windows and free up space on your hard disk, which can be beneficial if space is tight. However, to use a font again, you'll have to re-install it from the original diskettes.

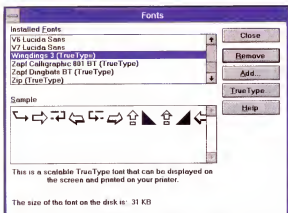
Another way of temporarily disabling fonts is to edit your Win.ini file directly. First, make a copy of your existing Win.ini file for safekeeping (this file is located in your WINDOWS

directory). You can copy Win.ini to another location on your hard disk, or you can rename it as Win.fnt and keep it in the WINDOWS directory.

Next, use a word processor, text editor (like EDIT), or Sysedit to edit the file. Search for the extension .FOT, as it indicates a TrueType font. Place a semicolon (;) at the beginning of those lines that contain the fonts you want to disable. If you previously renamed Win.ini to Win.fnt, be sure to save the file you're working on to Win.ini. Later, when you want to be able to access all your fonts, you can rename Win.ini as Win.old and either copy the original Win.ini back to the WINDOWS directory or rename Win.fnt as Win.ini.

If you use a lot of software, you probably have other fonts on your system besides TrueType fonts. Here are the file extensions associated with common fonts, which will help you identify where the specific font files are located on your hard disk.

- .FOT, .TTF, .TT—TrueType
- .AFM, .PFB, .PFM—Adobe Type 1
- .WFA, .WAO—Adobe Type 1 fonts used with WordPerfect
- .SPD—Bitstream Speedo
- .BCO, .CSD, .TDF—Bitstream bit-mapped fonts
- .SFP—Agfa Intellifont bit-mapped fonts
- .FON—Windows bit-mapped screen fonts and vector fonts ●



To speed up your system, delete unused TrueType fonts by highlighting them and clicking Remove.

Wait until the affected area is dry before you install a new cartridge.

It's best to ship a printer, or other piece of computer equipment, in its original container. The foam spacers in the original box will do a better job of protecting the equipment than generic foam chips.

- If you have a laser printer and the pages begin fading or vertically streaking, you're probably running out of toner. You should be able to get a few more pages out of the cartridge by taking it out and gently shaking it back and forth several times to redistribute the toner.

Recharging a laser printer cartridge, rather than buying a new one, can be a good way of economizing. But make sure the recharger doesn't simply drill a hole in the cartridge, add toner, and reseal the hole with tape. The tape can loosen over time and lead to nasty toner spills. Better rechargers disassemble, inspect, and recondition the entire cartridge.

- If your printer does go on the blink, rest assured that many printer problems are easy to solve. Printer cables can become dislodged if someone bumps into them. Perhaps the printer isn't online, there's no paper in the bin, or someone removed the ribbon and forgot to replace it.

Mysterious printer problems often can be solved by merely turning the printer off for a half a minute or so and turning it back on again. Printer cables can go bad. If the printer's self-test routine works but you can't print from two or more application programs, this usually indicates you need a new cable. Printer cables are inexpensive, and it's good insurance to have an extra one around.

Windows may make printing easy, but making the most of it can take some thought. It's a

worthwhile exercise, though, since how you look on paper often contributes significantly to how others look at you in general. ●

by Reid Goldsborough

For More Information:

Bitstream 500 Font CD For Windows
Bitstream Inc.
(800) 522-FONT
(617) 497-6222

CorelDRAW
Corel Systems Corp.
(800) 772-6735
(613) 728-8200

Epson Stylus Color Printer
Epson America
(800) 922-8911
(310) 782-0770

Fargo Primera Color Printer
Fargo PrimeraPro Color Printer
Fargo Pictura 310 Color Printer

Fargo Electronics
(800) 327-4622
(612) 941-9470

Font Works Express
ElseWare Corp.
(800) ELSEWARE
(206) 448-9600

Microsoft TrueType Font Pack For Windows
Microsoft TrueType Font Pack 2 For Windows
Microsoft Hewlett-Packard Font Set
Microsoft Windows Printing System
Microsoft
(800) 426-9400
(206) 882-8080

PrintCache
LaserTools Corp.
(800) 767-8004
(510) 420-8777

PrintQ
Software Directions
(800) 346-7638
(201) 584-8466

New Color Printers

The ultimate object of printing is to look your best on paper, and several new color printers have recently come on the market that do just that, at very affordable prices.

The Epson Stylus Color Printer is a new inkjet printer that's getting a lot of attention. It can deliver 720 x 720 dpi with near photographic-quality results. For top quality, you need to print on specially coated paper, which costs about 12.5 cents per sheet. You also can print on regular copy paper at 360 x 360 resolution, which is appropriate for text. The printer is available for about \$500 from computer stores and mail-order vendors.

The Epson Stylus makes it easy to switch between color and black-and-white. Both color and monochrome cartridges are installed in the printer at the same time, so you don't have to waste time switching one for the other or waste money printing black text with a color cartridge.

Another well-regarded series of low-cost color printers is available from Fargo. Unlike

the Epson Stylus printer, the Fargo printers use dye sublimation (also called dye transfer) technology, producing continuous tones, like a photograph developed in a darkroom, for even higher-quality results.

The least expensive option for photorealistic results is the Fargo Primera with its Photorealistic Upgrade Kit, which together cost about \$850 from computer stores and mail-order vendors. It wasn't long ago that you would have had to pay more than \$10,000 for a photorealistic, dye-sublimation printer.

Fargo also sells the Primera Pro (\$1,500 street price) and Pictura 310 (\$4,000 street price). The latter produces output as large as 11.95 x 17.4 inches. You need to use special paper for all of these printers, which cost about \$2.80 cents per sheet (including the ribbon needed to print on the paper). If you need top-quality results, though, the cost is more than worth it. ●

Upgrading Your PC



the newest and fastest components—usually leaves you with a system that's slower than a new system in which all the components are matched with one another.

Which approach works best? One rule of thumb is that the cost of any upgraded component should be less than 40% of the cost of a new system. If you have to pay more than this, consider selling your old system and buying a new one (see the sidebar "What To Do With An Old Computer").

There are many cases in which buying new components for existing systems does make sense. The following are the more common upgrades to consider.

■ Memory

Often the most cost-effective way to improve a PC's performance is to add random-access memory (RAM), which is where the PC stores information with which it's currently working. This is particularly true if you have Microsoft Windows or IBM's OS/2 and want to run more than one program at once. With too little memory, Windows swaps data from memory to your hard drive. Since a hard drive is many magnitudes slower than memory, this causes a major performance bottleneck. Additionally, some programs may be unable to run if you don't have the memory they require.

RAM upgrades are usually inexpensive—ranging from \$30 to \$50 per megabyte—and usually not too difficult to install. Newer PCs use snap-in memory modules called SIMMs (single in-line memory modules). When adding new SIMMs, you'll need to know a bit about the SIMMs you already have. You can check your system's manual or call the vendor

Every PC user faces the decision sooner or later: Should I upgrade, and how?

The reality of the personal computer industry is that things change so fast that it's easy to get left behind. Hardware gets faster. New kinds of hardware are introduced. New software is released that takes advantage of the new hardware, and soon your PC can't run any of the hot new programs.

Many people, however, are content with the programs they've used for years. The motto here is: If it ain't broke, don't fix it. If you use your computer primarily for business and the software you're running meets your needs, saving your discretionary funds for other purposes can be a smart move.

On the other hand, newer software—and hardware—can make you more productive. You'll finish tasks sooner, and you'll be able to use new tools that you may not have known

existed. Want to automate your bill paying? Prepare your own business cards, brochures, and newsletter? New software makes this easier than ever.

The enticement for home users to upgrade is even greater. Today's multimedia games and educational software won't run well, or at all, on older hardware.

■ Upgrade Approaches

There are two ways to upgrade your hardware: replace components piece by piece or replace the entire system. There are plusses and minuses to each approach.

Upgrading on a piecemeal basis is usually considerably less expensive than buying a new PC. But if you install the new hardware components yourself, it can be difficult getting them to work properly with your system. And replacing individual components—even with

from whom you bought the system, or open your computer's case and take a look yourself.

The memory banks in your PC will probably look a bit like a newsstand—the SIMMs, like magazines, sit at an angle in their sockets. Newer PCs usually use 72-pin SIMMs that measure 4-1/8 inches wide, while older ones use 30-pin SIMMs that are 3-3/8 inches wide. You need to buy the same type of SIMMs you already have.

You also must check the speed and capacity of your existing SIMMs. SIMMs are rated anywhere from 40 nanoseconds (ns) to 200ns—the lower the number, the faster and more expensive the SIMM. Most come in the 60ns to 80ns range. To determine the speed of your existing SIMMs, look at the last two numbers silk-screened on the top of each SIMM.

Don't buy SIMMs slower than your existing SIMMs—they'll likely crash your system. You can use faster SIMMs, but you won't be able to take advantage of their increased speed. It's best to choose SIMMs that are the same speed as those you already have.

Some newer PCs have as few as two SIMM slots, which often means that you'll have to replace existing SIMMs with larger capacity versions. You often can sell the SIMMs you replace to the vendor who sells you the new SIMMs.

Finally, you need to know whether your existing SIMMs support **parity checking** (a simple form of error checking). Again, use the same type of SIMMs you already have.

■ Video Card

Windows applications and similar graphical programs require that much more data be moved from your **central processing unit** (or CPU, where instructions issued by your software are fetched, decoded, and executed) to your screen than older DOS programs. If your PC doesn't have an accelerated video card, upgrading to one can improve the performance of your system dramatically.

Accelerated **video cards**, sometimes called **graphics accelerator cards**, can improve a monitor's **refresh rate** (the speed at which an on-screen image is redrawn) from three to 10 times over that of standard VGA cards. Consider buying a new video card if you frequently see the hourglass icon when you work with Windows applications.

Graphics accelerator cards are distinguished, among other things, by the resolutions supported, colors supported, refresh rate,

speed, extra features, and price. Most cards support **resolutions** (the sharpness of an on-screen image) up to 1,024 x 768, but the highest resolution supported may not be the best choice for your system. If you use a resolution that's too high for your monitor, the text on-screen will be too small. The optimal resolu-

**To prevent
eyestrain,
avoid
video cards
that employ
interlacing
at the resolution
you plan
to use.**

tion is 640 x 480 for a 14-inch screen, 800 x 600 for 15-inch and 16-inch screens, and 1,024 x 768 for a 17-inch screen.

The number of colors supported depends on the amount of memory the card comes with and the resolution you use. Using more colors than you need can slow you down. Sometimes 16 colors will suffice. For multimedia programs, the best choice is usually 256 colors. More colors—65,000 or 16.7 million—are useful for high-end image editing or computer-aided design.

A video card's refresh rate affects your comfort level. Low refresh rates can cause the image on-screen to appear to flicker, which leads to eyestrain and headaches. Any card you buy should meet the refresh standards of the Video Electronics Standards Association (VESA)—72Hz at 640 x 480 and 800 x 600 resolution and 70Hz at 1,024 x 768.

To prevent eyestrain, avoid video cards that employ **interlacing** at the resolution you plan to use. With interlaced mode, the card sends data to the screen in two passes, instead of one, which leads to a perceptible flicker. Most cards today are noninterlaced, though some use interlacing at very high resolutions.

Despite the benchmark scores cited by some manufacturers, the real-world speeds of new video accelerator cards are comparable. Cards that use VRAM (video random-access memory), however, tend to be slightly faster than cards that use DRAM (dynamic random-access memory), but they're also more expensive. Most quality replacement video cards cost \$150 to \$350.

■ Hard Drive

It wasn't long ago that 80MB hard drives were the standard. Today, 80MB is woefully inadequate as software programs demand more space. Installing the standard version of Novell's *PerfectOffice*, for instance, can occupy 98MB by itself, while the professional version fills 138MB.

Today's systems usually come with hard drives that are 500MB or larger. If your older hard drive is running out of space, you have three options: using on-the-fly disk compression software, buying an additional hard drive to use with your existing one, or replaying your existing hard drive.

Popular disk compression programs include DoubleSpace (shipped with MS-DOS 6.2), DriveSpace (shipped with MS-DOS 6.22), and *Stacker*. (Stacker, from Stac Electronics, is a well-regarded, third-party compression program.)

Compression programs can nearly double your effective hard drive space. But they enact a slight speed penalty and can make hard drive troubleshooting more difficult. Still, using a compression program, particularly if it comes with your system software, is less expensive than buying a new hard drive.

Buying a new hard drive makes sense, however, if you want more space without compromises. Today, you can find 500MB drives for about \$225. The two most common hard drive types today are IDE (Integrated Device Electronics) and SCSI (Small Computer System Interface) drives. IDE drives are typically lower priced and easier to install and support, while SCSI drives provide better performance, higher capacity, and more versatility. In most cases, IDE is the way to go for standalone PCs, and SCSI is more appropriate for network file servers and high-end workstations.

In terms of size, "however large a hard drive you think you'll need, buy a larger one," recommends Bill Wolff, president of Wolff Data Systems of Dresher, Pa. People often underestimate the size of the drive they need. To take advantage of a large hard drive, though, you

also may need to upgrade your PC's BIOS (Basic Input/Output System), a chip that helps regulate peripherals. Check with your PC's manufacturer to be sure.

■ Fax Modem

If your PC didn't come with a fax modem, buying one can be a smart move as it connects you to local bulletin board systems, commercial online services, and the Internet. A fax modem also lets you send and receive fax transmissions directly from your PC.

A modem connects your computer to the outside world via telephone lines by translating a computer's digital signals (0s and 1s) into the analog sounds that a telephone can transfer, and vice versa.

Modems come in two basic varieties—internal and external. Internal modems, which are attached to an expansion slot in your PC, are slightly less expensive than external modems, which are housed in their own cases. It's easier to transfer an external modem among different computers and, unlike an internal modem, it always provides visual feedback about the status of its operation.

Modems also come in different speeds, measured in bits per second (bps), a bit being the smallest unit of information a computer can

handle. Modems are sometimes erroneously described in terms of baud rate—baud rate and bps do not mean the same thing, though they're sometimes used interchangeably.

Some 2400bps (and slower) modems are still used, but a 14,400bps (14.4Kbps) modem is the slowest you should consider buying. The price differences today are slight—you can find a 14.4Kbps modem for less than \$100. Modems with top speeds of 28.8Kbps, based on the V.34 standard, are also available. They're not yet as reliable as 14.4Kbps modems, and they're still a bit pricey. But prices for V.34 modems should drop to less than \$200 this year.

■ Multimedia Upgrade Kit

Another rage these days is multimedia. CD-ROMs (compact disc, read-only memory) are small, silvery platters that are physically identical to those used in CD players and hold computer data. Unless you have a special recording device, you can only retrieve data from the discs and can't store new data on them.

The primary benefit of CD-ROMs is their capacity. Typically, they hold about 650MB, the equivalent of about 450 high-capacity floppy diskettes, 600,000 typewritten pages, or 500 full-length novels. Imagine holding 500 books in the palm of your hand. If you were standing at

street level, the books would reach three stories high and give you one serious muscle cramp.

CD-ROMs hold text, drawings, photos, voice, music, sound effects, animation, and video. Having access to this combination of different media is the main reason CD-ROMs have become so popular. According to Dataquest, a San Diego-based market research firm, sales of CD-ROM titles grew 227% in 1994 from 1993.

If you have a computer without a CD-ROM drive, you may be able to upgrade it by purchasing a multimedia upgrade kit, which usually costs \$200 to \$400. These kits usually include a CD-ROM drive, sound card, and external speakers. You can install an upgrade kit yourself, but it can be tricky to get the kit's components to work correctly with your PC's components.

Local computer stores, which sell the kits, usually can install them for you for a small charge. When you bring in your PC, make sure you also bring the original floppy diskettes that came with it so your video driver can be upgraded if needed. Also, ask for a double-speed or faster CD-ROM drive and shielded speakers.

■ CPU/Motherboard

Replacing your CPU may be the biggest upgrade decision you'll make. A CPU upgrade

What To Do With An Old Computer

If you've bought a new computer and don't want to keep your old one, you have several options: online ads, used computer exchanges, and charity organizations

■ The Internet

The Internet provides more than 10,000 forums, called Usenet newsgroups, that are used mostly as discussion groups. But there are some for buying and selling used computers and ads usually can be placed free of charge. Newsgroups related to buying and selling computers include:

- **misc.forsale.computers.mac**—Apple Macintosh-related computer items
- **misc.forsale.computers.other**—Miscellaneous computer items
- **misc.forsale.computers.pc-clone**—IBM PC-related computer items
- **misc.forsale.computers.workstation**—Workstation-related computer items

- **comp.sys.apple2.marketplace**—Buying, selling, and trading Apple II equipment

Buying and selling through Usenet is relatively safe. "Many thousands of successful transactions have taken place, with only a small number of incidents of fraud," says Daniel King, who maintains the Frequently Asked Questions (FAQ) file for the misc.forsale hierarchy. "Many satisfied computer users have walked away from here knowing they got the best deal available."

Still, King recommends shipping items COD. "The few extra bucks are worth the hassle that could arise," he says. He also recommends paying by check or cashier's check so you can stop payment "in the unlikely event the sender sent you an expensive brick."

The used computer market is a buyer's market, because prices for new computers have fallen substantially. Therefore, be realistic when selling a used computer. In determining

your asking price, look at what new systems and similar used systems are selling for.

■ Dealers & Exchanges

Used computer dealers buy PCs from sellers and keep them until they find a buyer. There are many local dealers around the country who buy used PCs—check your Yellow Pages to see if there's one near you.

On a national level, there are used computer exchanges that match buyers with sellers. Although they don't keep PCs in inventory, they do maintain databases of available systems.

In an exchange, you specify the offer price. Buyers can, however, make a bid that's lower than your price. You then can accept it, reject it, or make a counter offer.

When a deal is reached, you ship the system to the exchange's facility, where technicians run diagnostic tests to ensure it's working properly. At the same time, the buyer

will make your PC run faster, which is especially useful if you crunch large spreadsheet files, manipulate large graphics files, or do any other tasks that tax your existing processor.

Cyrix sells replacement 486 CPUs, which cost anywhere from \$200 to \$400, for 386-class computers. They'll improve performance, but they won't make your PC as fast as a PC with a native 486 chip.

You may be able upgrade a 486-class PC with an Intel Pentium OverDrive chip or a 486 OverDrive chip that's speedier than your current CPU. A Pentium OverDrive chip improves performance, but it won't make your PC as fast as a system with a native Pentium processor. At \$449 for the 63MHz version, it's also fairly expensive.

What's more, not all Pentium OverDrive chips work with all systems. Check with Intel to see if it has tested and verified the type and brand of PC you have to make sure it's compatible with the Pentium OverDrive chip. Even if it is compatible, you may have to move jumpers, change your BIOS settings, or replace your BIOS for it to work.

If you have an SX CPU or an older 286 or XT computer, you can add a math coprocessor, which is designed to speed up certain calculation-intensive activities, such as spreadsheet re-

calculations. Not all programs take advantage of math coprocessors, so check to see if your programs will benefit. The price can be reasonable though—for a 386SX computer, math coprocessors cost \$30 to \$60.

Short of buying a new computer, you'll get the best performance boost by replacing your **motherboard**. This is a PC's main circuit board, and it houses and connects the CPU, math coprocessor, memory sockets, system bus, and sometimes chips for the video display, serial and parallel ports, disk drive, and mouse as well.

Replacing a motherboard can be considerably more difficult than replacing or adding an individual chip on it, so leave it to a computer technician. Replacement motherboards cost anywhere \$200 or less for a 486SX-25 to close to \$1,000 for a 90MHz Pentium.

Upgrading decisions aren't easy. But if you make a wise decision, it can make you more efficient at the keyboard and increase your enjoyment of your PC. ●

by Reid Goldsborough

For More Information:

*Cyrix Replacement CPUs
Math Coprocessors*

Cyrix
(800) 462-9749
(214) 994-8387

Intel OverDrive CPUs
Intel
(800) 538-3373
(503) 629-7354

SoundBlaster Multimedia Upgrade Kits
Creative Labs
(800) 998-5227
(408) 428-6600

Stacker
Stac Electronics
(800) 522-7822
(619) 794-4300

U.S. Robotics Fax Modems
(800) 342-5877
(708) 982-5010

Western Digital Caviar Hard Drives
Western Digital
(800) 832-4778
(714) 932-4900

sends the exchange a personal or company check or money order. They hold the funds in escrow until the system checks out and the check clears, at which time they'll ship the system to the buyer via UPS.

When buyers receive their PC, they have two additional business days to examine it. The buyer then verifies by phone that all is well, and the exchange releases the buyer's funds to you, minus a commission. Typical commissions range from 10% to 15% of the sale price.

Here are some of the largest exchanges (Boston Computer Exchange, however, is actually a dealer):

American Computer Exchange
(800) 786-0717
(404) 250-0050

Boston Computer Exchange
(800) 262-6399
(617) 542-4414

National Computer Exchange
(800) 622-6639
(212) 614-0700

United Computer Exchange
(800) 755-3033
(404) 612 1205

■ Good Causes

You also can donate your PC. There are organizations that place used computers with secondary schools and universities, job training centers, senior organizations, correctional facilities, shelters and other transitional housing facilities, and community-based organizations.

If you haven't depreciated a PC that you've used for business purposes, you may be able to take a tax deduction when you donate it.

Regardless of whether you sell your old system or give it away, remove the software from your hard drive if you intend to use it with

your new system; otherwise, you'll be using illegal copies. Or, sell or donate your software (including the manuals) and buy new software.

The following organizations can help you with your donation:

Computers For Schools
(619) 456-9045

Computer Recycling Center
(415) 428-3700

East-West Foundation
(617) 542-1234

Gifts In Kind America
(703) 836-2121

National Christina Foundation
(203) 622-6000 ●

The World's In Your Hands . . . With The Internet!

You've just purchased a modem, and you're ready to join your family and friends on the Information Superhighway. But how do you communicate with your brother on CompuServe, your parents on America Online, your old roommate on Prodigy, and your children on Delphi without spending a small fortune in subscription charges each month? Easy. Use the Internet.

Although the Internet is the world's most-used online network, with an estimated 30 million users worldwide, it has been ignored by many regular users of online services. The primary reason for this is that the Internet, as a conglomeration of smaller networks, lacks the centralized corporate office that most of the commercial online services offer. The Internet has no technical support line, no 800 help numbers, and no instruction manuals to offer to prospective users. Therefore, many rookie onliners assume that the Internet is a network

for hackers. However, it's quite easy to maneuver around the Internet and send E-mail once you become familiar with it.

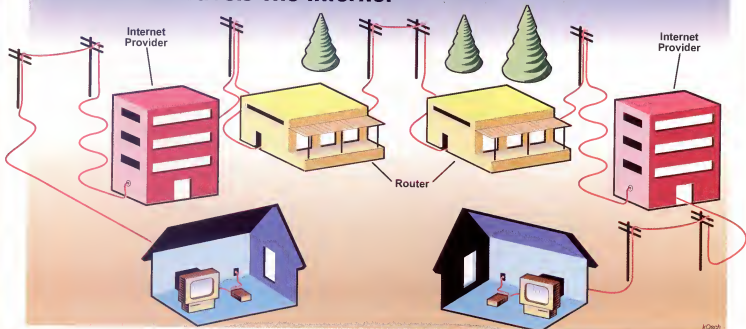
If you don't subscribe to a commercial online service such as CompuServe or Prodigy and you can't afford to lease a direct line to the Internet (price: about \$1,000 every six months), then you have two alternatives for gaining access to the Internet: 1) indirectly, through a shell account; or 2) directly, through a **Serial Line Interface Protocol (SLIP)** or **Point-to-Point Protocol (PPP)** connection. (SLIP and PPP are popular **communications protocols**, which are standards that let computers communicate with each other.) While the indirect means of access to the Internet is somewhat limited in its online multimedia capabilities, both a shell account and a SLIP/PPP connection, available from most local and national Internet access providers, are adequate for sending and receiving E-mail.

■ Down To Business

Once you've decided on a way of accessing the Internet, you need to prepare your modem and communications software so that you can send and receive E-mail. A **baud rate** (data transmission speed) setting of 2400; a terminal emulation setting of VC100; and a modem setting of eight data bits, no parity, and one stop bit (often written as 8-N-1) is the usual configuration, but you should check with your host terminal for the modem settings that it recommends.

Connecting to your host terminal is a matter of engaging your modem and entering the number of your host terminal. It's common for your modem to emit a strange hissing and screeching noise while connecting, although it may be a little unsettling if you are not expecting it. Once you are connected to the Internet, you need to enter your E-mail program.

How E-mail Travels The Internet



E-mail messages pass through a series of routers that continually directs them to their intended destinations. Routers simply direct the course of the electronic signals so that they can travel most efficiently from one location to another. An E-mail message may run through any number of routers on its journey.

You can use two types of programs for sending E-mail. The first type involves using a text-based system, such as *elm*, while the other uses a program with a graphical user interface (GUI, pronounced "goopy"), such as *Eudora*. (Sorry. You can't use a GUI program if you have a shell account.) The way you engage your E-mail program will depend on which program you've decided to use. In a text-based system, you either select the program from a menu or enter the name of the program at the prompt. In a GUI program, you simply double-click the appropriate icon.

■ Text-Based Mail Programs

If you have a shell account or prefer to use DOS rather than Windows, you'll have to use a text-based E-mail program. Because of the number of text-based programs available, we will focus on the *elm* E-mail program. Although you may not use *elm*, the procedure for sending E-mail through it will resemble that of most other text-based E-mail programs.

To enter *elm*, type *elm* at the C> prompt. After pressing ENTER, type *m* at the main menu, and hit ENTER again. Your screen then will prompt you with To: where you will enter the E-mail address of your intended recipient. After hitting ENTER, you'll see a Subject prompt where you will enter a short statement that briefly explains the contents of your letter. Press ENTER again. You may see a Copies To: prompt at this point where you will enter the addresses of anyone else that you would like to receive copies of your message. Upon pressing ENTER, you will be in your text editor, where you can compose the text of your message.

After you have completed the letter, you'll need to exit the text editor and return to the command mode, which is usually done either by pressing CTRL-X or by pressing ESC, ENTER, and then typing *w q*. Once you've exited the text editor, the menu will present a list of options. From your list of options, type *s* if you would like to send the message, *f* if you would like to delete the message before sending, or *e* if you would like to change the message in some way.

If you have received mail, you may see an itemized index of E-mail messages that you have received at the main menu or a message that reads "You have new mail." To read your mail, type in the number of the message you

Addressing E-mail to the Internet from a service outside the Internet:

Online Services	Address Format	Examples
From America Online:	<i>username@host</i>	<i>jsmith@plato.rf.edu</i>
From AT&T Mail:	<i>internet:hostname</i>	<i>internet:plato.rf.edu/jsmith</i>
From CompuServe:	<i>internet:username@host</i>	<i>>internet:jsmith@plato.rf.edu</i>
From Delphi:	<i>in%"username@host</i>	<i>in%"jsmith@plato.rf.edu</i>
From GENie:	<i>username@host@INET#</i>	<i>jsmith@plato.rf.edu@INET#</i>
From MCI Mail:	TO: <i>user's full name</i> (EMS) EMS: Internet MBX: <i>username@host</i>	To: John Smith (EMS) EMS: Internet MBX: <i>jsmith@plato.rf.edu</i>
From Prodigy:	<i>username@host</i>	<i>jsmith@plato.rf.edu</i>

Addressing E-mail to another network from the Internet:

Online Services	Address Format	Examples
To America Online:	<i>username@aol.com</i>	<i>jsmith@aol.com</i>
To AT&T Mail:	<i>username@attmail.com</i>	<i>>smith@attmail.com</i>
To CompuServe:	<i>user.number (use period rather than comma) @compuserve.com</i>	<i>9876.43231@compuserve.com</i>
To Delphi:	<i>username@delphi.com</i>	<i>jsmith@delphi.com</i>
To GENie:	<i>username@genie.geis.com</i>	<i>jsmith@genie.geis.com</i>
To MCI Mail:	<i>username@usernumber/real_name@mcimail.com</i>	<i>jsmith@mcimail.com</i> OR <i>2845839@mcimail.com</i> OR <i>John_Smith@mcimail.com</i>
To Prodigy:	<i>username@prodigy.com</i>	<i>jsmith@prodigy.com</i>

would like to read and press ENTER. Pressing the spacebar automatically will present the next message to you. If you would like to return to the index, type *i*.

■ GUIs

If you have a GUI E-mail program, using E-mail on the Internet is as simple as navigating around a Windows screen. We used the *Eudora* program for our example. Other GUI programs should resemble *Eudora*'s basic structure.

After dialing up your host computer and double-clicking on your E-mail program icon, you will be asked to enter your password so that you can be admitted into the program. If you have received any mail, a message then will appear on your screen to inform you. Clicking on the Mail menu will let you access mail that you have received and sent. Click on the New command in the Message menu to enter the text editor and compose your letters. At the head of these electronic letters are slots labeled To:, From:, and Subject. You should fill these in before sending your letter. (Your E-mail program

may automatically enter your name in the From slot).

Many GUI E-mail programs have a Nickname or Alias file where you may save often-used E-mail addresses under aliases for easy recollection. If you wish to send a message to someone whose address you have stored under an alias, you enter the alias name rather than the address at the To: prompt. Consult your file menus to find the location of your Nicknames or Alias command.

After you've composed your letter, click on the Send box, and your electronic message will head for its destination. To exit your E-mail program, double-click on the Exit command under the File menu.

Electronic communication has made the world a small place. Because of its international popularity and the universality of its network system, the Internet can make the world even smaller. Learning to use E-mail on the Internet will give you the ability to make the world so tiny that it's accessible through your fingertips. ●

GLOSSARY

Of Terms

A-B Box—Switching device used to connect one computer to two peripherals or two computers to one device. For example, a laser printer may be shared by two desktop computers. If Computer A wants to send something to the printer, the switch would be turned to A. If Computer B needs to print something, the switch would be turned to B.

Access Time—The time it takes to retrieve data from memory and send it to the device requesting it.

Backward Compatibility—Allows files created in an older version of software to be accessed and worked with in a newer version of the same software. For example, word processing documents created in *Microsoft Word 2.0* can be used in version 6.0 of the same program.

Baud Rate—Roughly speaking, the number of bits of data that a modem can transmit per second. Technically speaking, a baud equals the number of transitions (either in terms of voltage or frequency changes) made per second.

BBS—Bulletin Board System. An electronic version of a public bulletin board you might find in a company lunchroom or community center. Using a modem, users connect to a BBS and download files and leave messages for each other.

BIOS—Basic Input/Output System. A set of routines that works with a computer system's hardware to support data transfers between the various elements of a system, such as the monitor or disk drives.

Bit—The smallest unit of computer data. Each bit has a value of either 0 or 1 that tells whether an electronic pulse is "off" or "on," respectively.

BPS—Bits Per Second. A unit used to measure the number of data bits a modem can transfer in one second.

Byte—A standard unit of computer measurement equaling eight bits. One byte is the amount of information needed to produce a keyboard character, such as a letter or number.

CD-ROM—Compact Disc, Read-Only Memory. A data storage medium that uses laser optics rather than magnetic means for reading data. CD-ROM discs look like the audio CDs available in music stores.

CISC—Complex Instruction Set Computing. Found in Intel's 80386 early chips and Motorola's 680x0 chips, CISC chips recognize a large number of instructions and compute complicated instructions efficiently, causing, however, a slightly slower performance rate than RISC chips.

Clock Speed—Computers contain internal clocks, called system clocks, that the microprocessor uses to regulate vibrations to measure speed. The faster the clock speed, the faster the computer will execute commands.

Communications Protocols—The standards that let computers communicate with each other.

Compression—A technique that makes computer data smaller so that less data is needed to represent the same information. Consequently, the information takes up less disk or file space and may be transmitted in less time.

CPU—Central Processing Unit. Also called the microprocessor, this chip acts as the "brain" of the computer. It controls the computer's actions and can find, decode, and carry out instructions and assign tasks to other computer resources, such as a coprocessor.

Data Transfer Rate—The maximum rate at which data can be transferred from one device to another, commonly measured in bits per second (bps).

Device Drivers—Software that lets the computer communicate with hardware devices, such as a mouse or audio speakers.

Differential Backup—A process that copies only those files that have changed or been added since the last full system backup was performed.

DMA—Direct Memory Access. Memory access that doesn't involve a computer's microprocessor, dealing instead with the direct data transfer between memory and a peripheral device.

DOS—Disk Operating System. Software that translates a user's commands and lets application programs interact with the computer's hardware. Supplies a file management system for efficient disk input/output.

DPI—Dots Per Inch. The number of pixels (dots) contained within an inch of an on-screen or printed image.

DRAM—Dynamic Random-Access Memory. A form of semiconductor RAM in which the processor and video circuitry share the same control pins on a RAM chip. DRAM stores information in integrated circuits containing capacitors, which need to be recharged continuously.

Expansion Slot—A socket inside the computer case that is designed to hold expansion cards.

Extended Architecture—A technology that extends the capability of standard CD-ROM discs. To run such a CD-ROM, you would need an XA-ready CD-ROM drive as well as an XA decoder board. The technology, as yet, is not widely available.

Firmware—Instructions embedded on a chip.

Gigabyte—Common measurement of storage memory that is approximately equal to one billion bytes.

GUI—Graphical User Interface. A graphics-based interface that lets you access

programs by pointing to icons, buttons, and windows rather than typing strings of commands at a command prompt.

IDE—Integrated Device Electronics. A disk drive interface that eliminates the need for a separate adapter card because the controller electronics reside on the actual drive.

Incremental Backup—A process that copies only the files added or changed in a specific time period, i.e., a day.

Internet—A non-commercial, self-governing network devoted mostly to communication and research with some 20 million users worldwide. The Internet is not an online service and has no real central "hub." Rather, it is a collection of tens of thousands of networks, online services, and assorted single-user computers.

IRQ—Interrupt Request Line. The physical hardware connection over which computer components send interrupts, or requests, for service to the microprocessor. IRQs are assigned different levels of priority, allowing the microprocessor to determine the importance of each request.

KB—Kilobyte. A unit of measurement of computer memory equivalent to approximately one thousand (1,024) bytes.

Math Coprocessor—An optional chip that can be connected to the microprocessor to speed up mathematical and graphical functions.

MB—Megabyte. A common measurement of storage memory that is equal to approximately one million bytes.

MHz—Megahertz. Used to measure a computer system's speed, 1MHz is equivalent to one million cycles per second. When everything else is equal, the higher the MHz measurement, the faster the computer.

MIPS—Millions Of Instructions Per Second. A unit of measurement that gauges how quickly a microprocessor can process instructions per second, but the measurement may be misleading because the types of instructions can be manipulated.

Modem—A device that lets computers communicate and exchange information over telephone lines.

Motherboard—The printed circuit board that is the foundation of a PC system. This board contains the computer's CPU, RAM, chips, and expansion slots that let you add more functions to your PC.

Multitasking—A method of operation provided by an operating system that lets a computer work on more than one task at a time.

Operating System—The software that controls your system and provides the basis for all other software you run on it. Examples of operating systems are DOS and OS/2 for IBM-compatible computers and System 7 for Macintosh computers.

Pixel—A picture element, or the smallest graphic unit, that can be displayed on your screen. A pixel is usually a single-colored dot.

PostScript—A printer control language that lets you add patterns and shapes in and around a document's text and provides scalable fonts, which can be enlarged or reduced to virtually any size.

Printer Driver—Software that controls the translation of text from computer monitor to printer.

RAM—Random-Access Memory. The temporary storage area used to load program instructions and store files currently in use. Unless a file is permanently stored on a hard drive, diskette, or other storage medium, changes to information stored in RAM will be lost because RAM is cleared when a computer is turned off.

Refresh Rate—How fast the computer renews the screen, which is about 50 to 75 times a second.

Resolution—The clarity attained by a computer monitor or printer in the production of an image. Resolution is measured in terms of the number of pixels per unit of measurement (such as an inch) and represents the number of pixels displayed horizontally and vertically in the image (i.e., 300 x 600).

RISC—Reduced Instruction Set Computing. Found in PowerPC and Alpha microprocessors, RISC chips execute simple instructions faster than CISC microprocessor, which is designed to handle a wider array of instructions. If a RISC chip is fast enough, it still can

process complex instructions as fast or faster than CISC chips.

ROM—Read-Only Memory. Memory in a computer system that can be read but not modified.

SCSI—Small Computer System Interface. Used for connecting computers to peripheral devices (i.e., CD-ROM drives or printers), other computers, and local-area networks. Peripheral devices are attached to a single SCSI port through a series of connections called a daisy chain. Each device is assigned a priority number or address. Transmissions through the port only occur one device at a time and peripherals with the highest priority number are the first in line for transmission.

SIMM—Single In-line Memory Module. Small circuit boards that accommodate memory chips; smaller than traditional memory hardware, they use less space on the motherboard.

Superscalar—The technology used in the Pentium chip, which allows microprocessors to move information through two parallel pipelines instead of one. One part of each pair of instructions is sent to each pipeline.

SVGA—Super Video Graphics Array. A high-resolution display standard for IBM-compatible PCs that displays 1,024 pixels horizontally by 768 pixels vertically.

Throughput—The modem's speed, with compression taken into account.

TrueType—Scalable fonts that can be printed or displayed on-screen at any size.

TSR—Terminate-And-Stay-Resident. A program designed to remain in memory so that it can be popped up in any program. When a TSR is loaded, its action can be terminated without completely removing it from memory.

VGA—Video Graphics Array. A popular display standard for IBM-compatible PCs that displays 640 pixels horizontally by 480 pixels vertically.

VRAM—Video Random-Access Memory. A special type of DRAM that's used in high-speed video applications. With VRAM, the processor and video circuitry use separate control pins on RAM chips, which lets the video circuitry access memory bit by bit.



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